5-3895-333-15

TM 5-3895-333-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

Operator, Organizational, Direct Support,
General Support and Depot Maintenance Manual

HAMMER, PILE-DRIVER, SELF-POWERED, W/FUEL OIL TANK AND LUBRICATING OIL TANK (LINK-BELT SPEEDER MDL 440) FSN 3895-854-4150

This reprint includes all changes in effect at the time of publication—Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
DECEMBER 1968

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SAFETY PRECAUTIONS

The penetrating power of oil under pressure is sufficient to puncture the skin and may cause blood poisoning. Therefore, hands must be kept away from the spraying nozzle.

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 13 December 1968

TECHNICAL MANUAL

NO. 5-3895-333-15

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

HAMMER, PILE-DRIVEN, SELF-POWERED W/FUEL OIL TANK AND LUBRICATING OIL TANK (LINK-BELT SPEEDER MDL 440)

FSN 3895-854-4150

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PREFACE

THIS MANUAL WAS PREPARED TO ACQUAINT THE OPERATOR AND SERVICEMAN WITH THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE DIESEL PILE HAMMER. WE SUGGEST THAT THIS MANUAL BE CAREFULLY STUDIED BEFORE OPERATING OR UNDERTAKING ANY MAINTENANCE WORK ON THE HAMMER.

THIS MANUAL IS ORGANIZED INTO SECTIONS WHICH COVER SERVICE INFORMATION. THE APPROPRIATE SECTION CAN READILY BE FOUND BY CONSULTING THE QUICK REFERENCE SYSTEM LOCATED IN THE FRONT OF THIS BOOK.

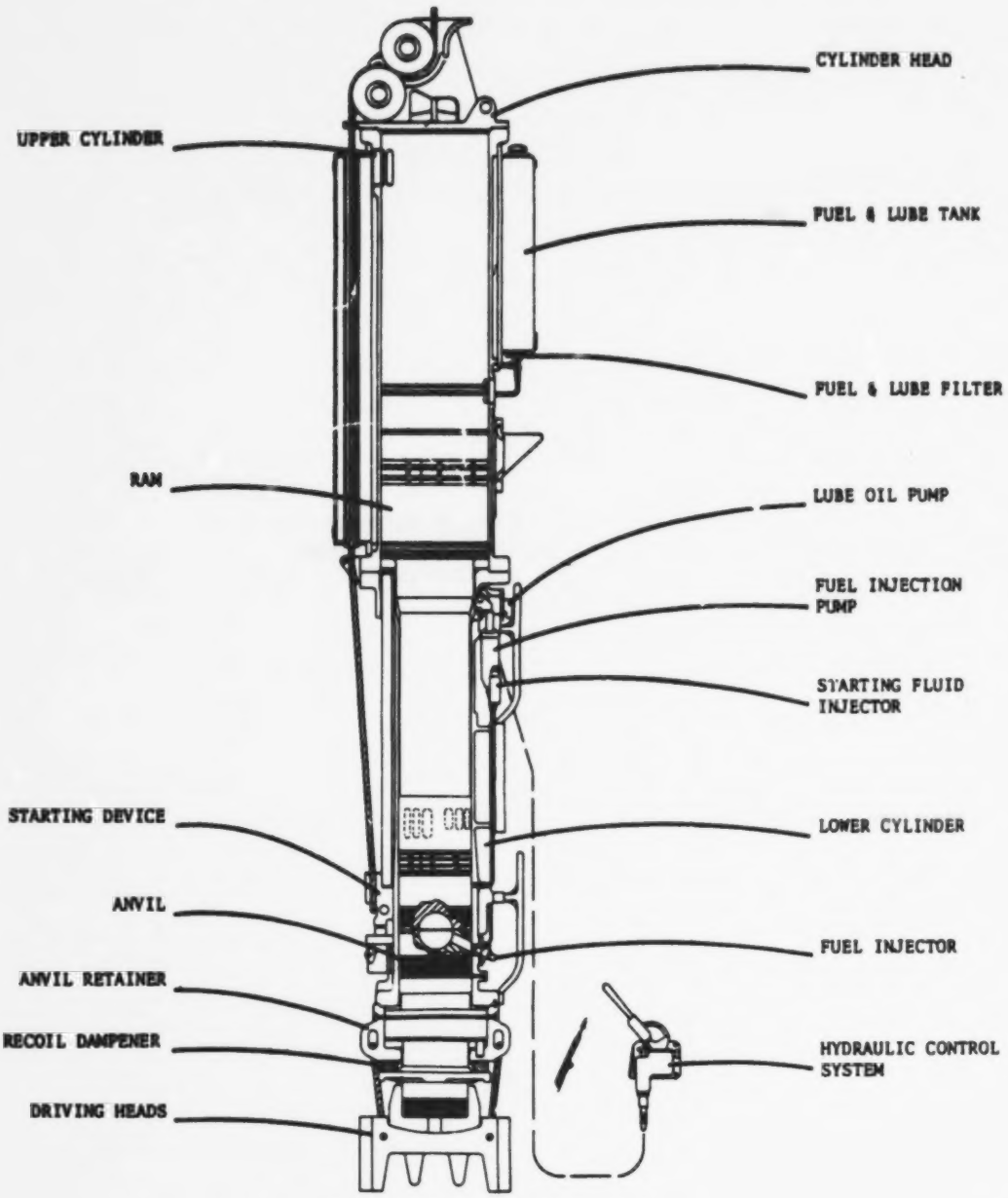
THE DIESEL PILE HAMMER, JOINED WITH THE FAMILY OF OTHER LINK-BELT SPEEDER MACHINES, INCORPORATES THE BEST OF ENGINEERING KNOWLEDGE, YEARS OF TECHNICAL EXPERIENCE AND IS CONSTRUCTED IN ACCORDANCE WITH THE HIGH STANDARDS OF THE COMPANY.

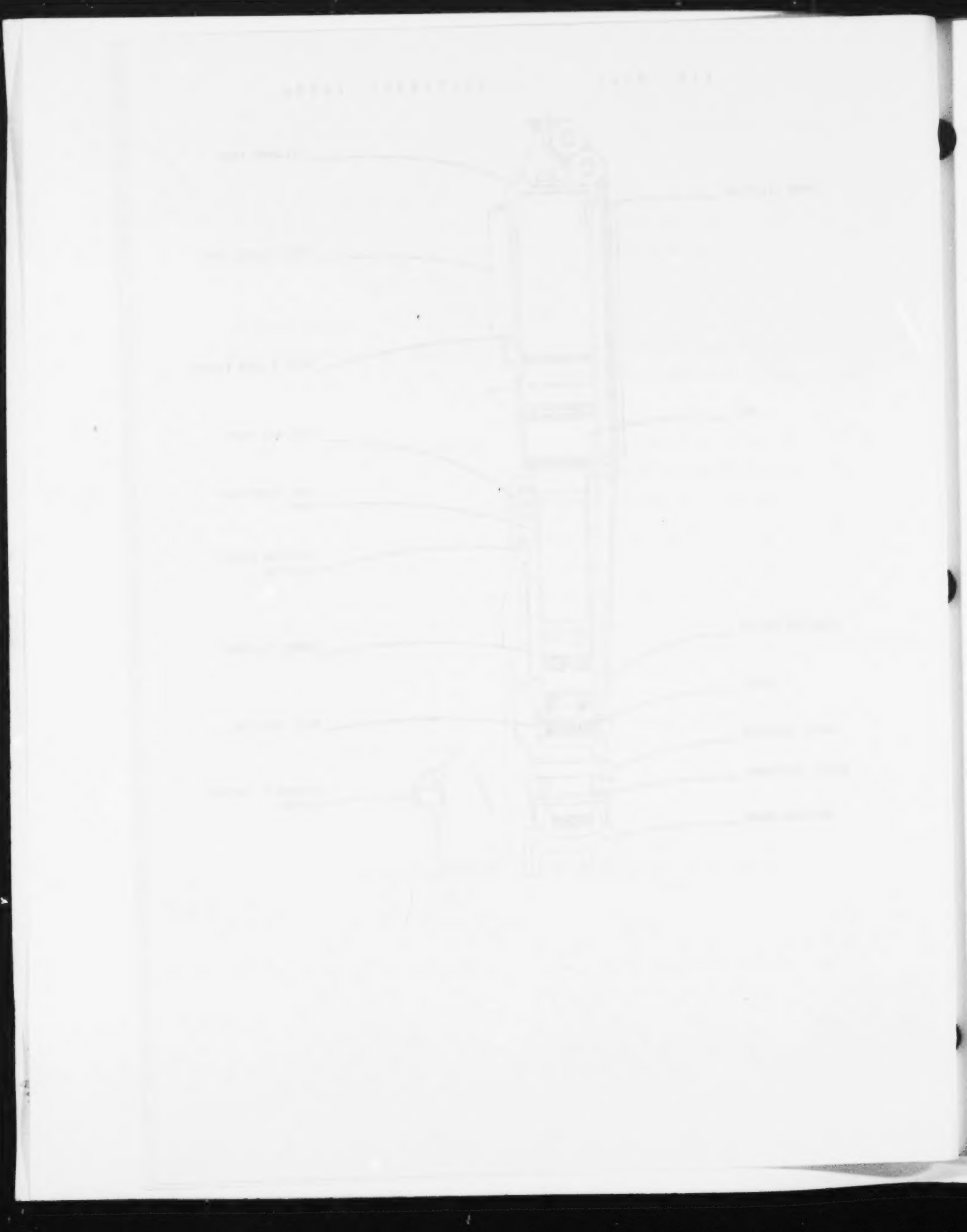
ALL MACHINES AND EQUIPMENT REQUIRE SYSTEMATIC, PERODIC INSPECTION AND MAINTENANCE IF THEY ARE TO PERFORM SATISFACTORILY OVER A LONG PERIOD OF TIME. THE DIESEL PILE HAMMER IS PRIMARILY AN IMPACTING MACHINE AND IF NOT GIVEN THE BEST OF CARE, OR IF IMPROPERLY USED AND MAINTAINED, IS SELF DESTRUCTIVE. THEREFORE, THE HAMMER SHOULD RECEIVE AT LEAST THE SAME CARE AND MAINTENANCE AS OTHER HIGH QUALITY CONSTRUCTION EQUIPMENT.

WE DO NOT ATTEMPT TO COVER IN THIS MANUAL THE VARIOUS TYPES OF LEADS, SPECIAL DRIVING HEADS, PILING OR OTHER SPECIAL EQUIPMENT USED IN PILE DRIVING WORK.

FOR INSTRUCTIONS ON ORDERING PARTS, REFER TO TM 5-3895-333-25P

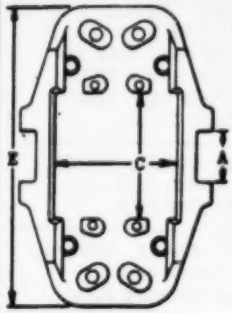
FIG. 8400 PICTORIAL INDEX



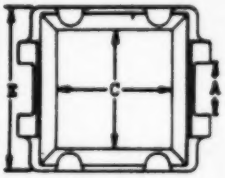


SECTIONS 2 AND 3
PAGES 2-1 THROUGH 3-4
NOT APPLICABLE

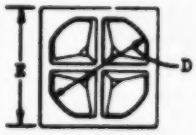
FIG. 8403 DRIVING HEADS & FILLERS - MODEL 440 LINK-BELT SPEEDER DIESEL PILE HAMMER



UP-R DRIVING HEAD



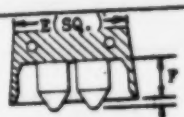
FILLER BASE



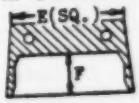
HT-1 FILLER

STYLE and PART NO.	WEIGHT LBS.	SIZE FILLER USED	DIMENSIONS (INCHES) A	B	C	D	E	F	G	H	CAN BE USED ON THIS PILING
UP-R DRIVING HEAD 13535M	1130	1	6½ to 9½	20	15	3/8	36½	6			14" H-BEARING PILE MP-101, 102, 110, 112 113, 115, 116 MZ-27 32, 38 ZP-32, 38 SP-4, 5, 6A, 7A DP-1, 2 AP-3 1-22, 23, 27, 28, 28S, 32
FILLER BASE	510	1 or 2	6½ to 9½	20	14	3/4	20	4½			CAUTION: A FILLER MUST BE USED WITH THIS FILLER BASE
HT-1 FILLER	240	FILLER MUST BE USED WITH UPR DRIVING HEAD OR FILLER BASE				13	3/8 14½	6			14" H-BEARING PILE PIPE PILING AS FOLLOWS: 14 O. D. x ½" MAS. WALL SEE NOTES 3&4 RECOMMENDED MIN. PILOT DIA. 8" DIA.
HP-1 FILLER 5Z1229M	300	FILLER MUST BE USED WITH UPR DRIVING HEAD OR FILLER BASE			12	3/4 9¼	14½	5	13½	1	10" & 12" H-BEARING PILE PIPE PILING AS FOLLOWS: 13 O.D. x 1" MAX. WALL 10 O.D. X 5/16" WALL SEE NOTE 3
SR-1 FILLER	225	FILLER MUST BE USED WITH UPR DRIVING HEAD OR FILLER BASE			12	3/4	14½	5	13½		12" H-BEARING PILE 12" SQUARE & OCTAGON PILE 10" HEXAGON PILE 13" O.D. ROUND PILE
W-2 FILLER 13536M	355	FILLER MUST BE USED WITH FILLER BASE			13		14½	7			WOOD
LT-2 FILLER	595	FILLER MUST BE USED WITH FILLER BASE			17½	13½	14½	5			PIPE PILING AS FOLLOWS: 12 O.D. x 3/16 MAX. WALL 14 O.D. X 3/16 MAX. WALL SEE NOTES 3 & 4 RECOMMENDED MIN. PILOT DIA. 11 DIA.

FIG. S403 DRIVING HEADS & FILLERS - MODEL 440 LINK-BELT SPEEDER DIESEL HAMMER (CONT'D)

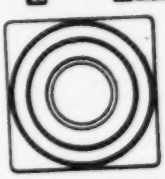


HP-1 FILLER



SR-1 FILLER

W-2 FILLER



LT-2 & ST-2 FILLERS

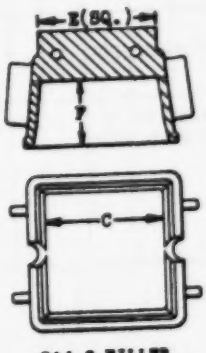
STYLE and PART NO.	WEIGHT LBS.	SIZE FILLER USED	DIMENSIONS (INCHES) A	B	C	D	E	F	G	H	CAN BE USED ON THIS PILING
ST-2 FILLER	450		FILLER MUST BE USED WITH FILLER BASE		13½	9½	14½	5			PIPE PILING AS FOLLOWS: 14 O.D. X 3/16 MAX. WALL 10 O.D. X 3/16 MAX. WALL SEE NOTES 3 & 4 RECOMMENDED MIN. PILOT DIA.= 7 DIA.
S14-2	330		FILLER MUST BE USED WITH FILLER BASE		14½		14½	8			14" SQUARE, OCTAGON, & ROUND PILE 12" HEXAGON PILE
S16-2	350		FILLER MUST BE USED WITH		16½		14½	7			16" SQUARE, OCTAGON, & ROUND PILE 14" 14" HEXAGON PILE
S18-2	475		FILLER MUST BE USED WITH FILLER BASE		18½		14½	7			18" SQUARE, OCTAGON, & ROUND PILE 16" HEXAGON PILE

NOTE 1. NOT APPLICABLE

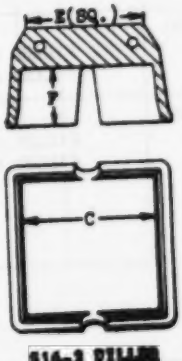
NOTE 2. NOT APPLICABLE

NOTE 3. IT IS RECOMMENDED THAT THE PILOT O.D. BE APPROXIMATELY 1/8" SMALLER THAN THE I.D. OF THE TUBE OR PIPE PILE.

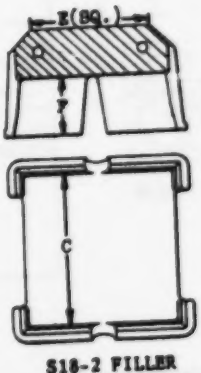
NOTE 4. PILOT DIAMETERS CAN BE MACHINED TO VARIOUS DIAMETERS AT A NOMINAL COST.



S14-2 FILLER

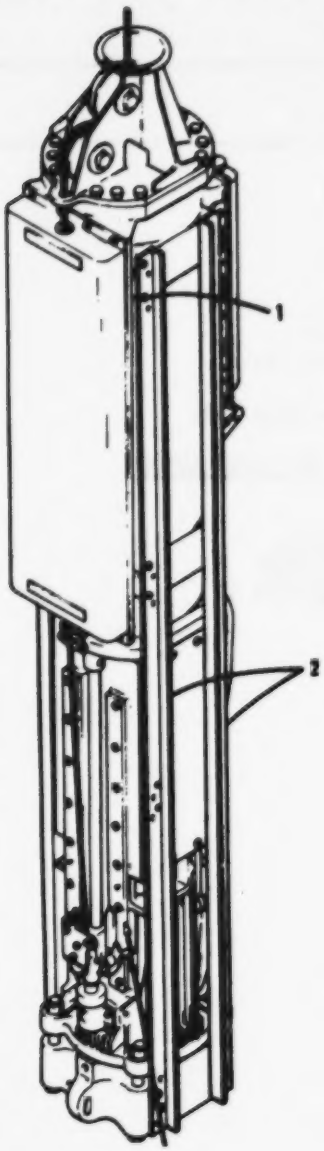


S16-2 FILLER

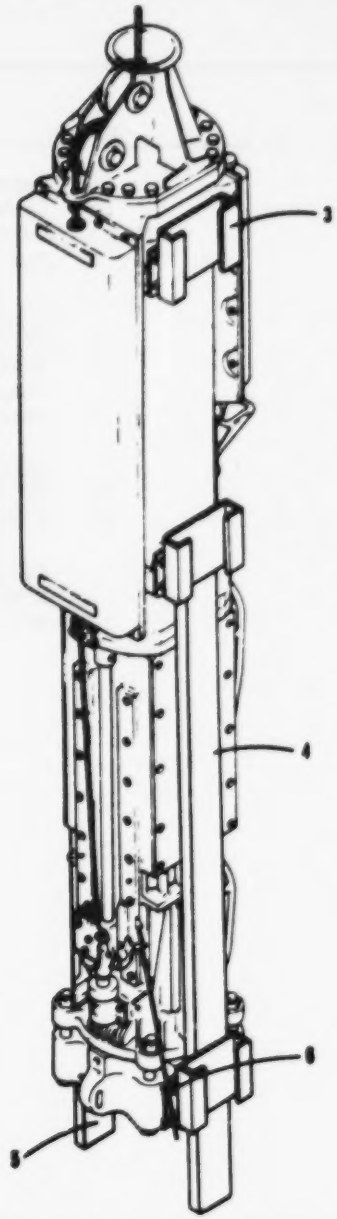


S18-2 FILLER

FIG. S-403A GUIDE ANGLES, SPUD CLIPS, PADS



Standard Guide Angles



Guide Clips for Spud Type Leads

FIG. 8403A GUIDE ANGLES, SPUD CLIPS, PADS

REF.	QTY.	DESCRIPTION
1	24	Capscrew
	24	Lockwasher 1"
2	4	Guide Angle
	6	Pad
		SPUD GUIDES
3	1	Upper Guide Spud Side
4	1	Head Guide, Spud Side, Weld Complete
5	1	Head Guide, Opposite Spud Side
		GUIDE CLIP HARDWARE FOR SPUD LEADS
6	20	Capscrew
	20	Spring Washer
		SEE SECTION 12 FOR HAMMER DIMENSIONS FOR ASSISTANCE IN BUILDING LEADS

SECTIONS 5 THROUGH 8
PAGES 5-1 THROUGH 8-6
NOT APPLICABLE

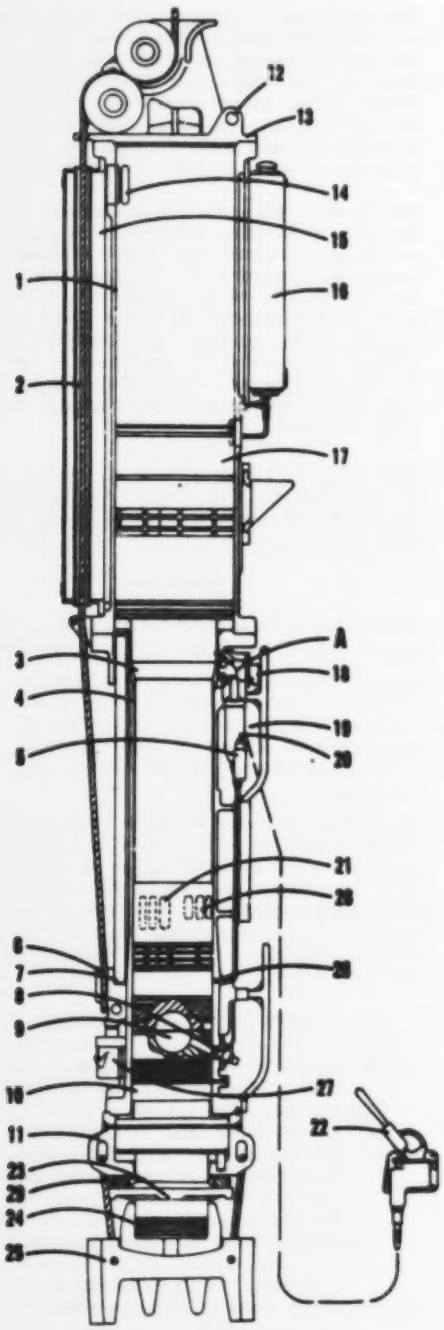


FIG. 9-1

MODEL 440 DIESEL PILE HAMMER

(A) RECESS FOR PRIMING LEVER

(1) UPPER CYLINDER
(2) STARTING DEVICE & HANDLING CABLE
(3) CAM SURFACE
(4) LOWER CYLINDER
(5) STARTING FLUID RESERVOIR
(6) LATCH BLOCK
(7) PUSH ROD.
(8) INJECTOR
(9) COMBUSTION CHAMBER
(10) ANVIL
(11) ANVIL RETAINER
(12) LIFTING EYE
(13) CYLINDER HEAD
(14) BOUNCE CHAMBER PORTS
(15) BOUNCE CHAMBER TANK
(16) FUEL & LUBE TANK
(17) RAM
(18) LUBE OIL PUMP
(19) RECEIVER
(20) FUEL PUMP
(21) INTAKE-EXHAUST PORTS
(22) TRANSMITTER
(23) RECOIL DAMPENER ADAPTER
(24) CUSHION ADAPTER ASSEMBLY
(25) DRIVING HEAD
(26) SCAVENGE PORTS
(27) DASH POT
(28) STARTING FLUID INJECTOR
(29) RECOIL DAMPENER

GENERAL DESCRIPTION

The LINK-BELT SPEEDER Model 440 DIESEL PILE HAMMER is a two cycle compression ignition scavenged engine, with a free piston. The piston, Fig. 9-1, is the "ram" which delivers the work output of the Hammer to the pile, driving the pile down.

This Hammer has fuel oil and lube oil tanks assembled to the upper cylinder making it a self contained unit. The enclosed cylinder head and bushed sheave arrangement allows center line hoisting of the Hammer for pile positioning and center line hoist for starting Hammer operation. A bell shaped top opening minimizes cable wear when handling the Hammer. The enclosed cylinder top also provides a faster Blow Rate. A scavenging system, not dependent on ram stroke sweeps residual gases from the cylinder.

The Hammer is started using a crane line or hoist line which is attached to the starting device. A latch release rope has to be pulled with all tension released from the hoist line before the locking pin can be released. The crane operator raises the lifting device with the release rope pulled. The push rod of the lifting device contacts the ram on the underside of the large diameter. The crane operator continues raising the ram until the Hammer just starts to lift, then immediately allows the ram and starting device to free fall in the cylinder. As the ram descends in the cylinder, the compressed air in the bounce chamber acts on the top of the ram to assist gravity to add velocity to the descending ram.

As the ram continues downward it covers the scavenge ports and the intake-exhaust ports to trap fresh air under the ram in the power cylinder. As the ram approaches the anvil, compressing the air into the combustion chamber, the cam surface on the ram rotates the cam roller and bell crank which operates the fuel and lube oil pumps. Atomized fuel is injected into the combustion chamber by the fuel pump at the same time a small amount of lube oil is pumped into the upper and lower cylinders.

Atomized fuel mixes with the compressed air in the combustion chamber and ignites. The fuel air mixture burns and expands to drive the ram upward and continue forcing the anvil downward.

As the ram rises, it pulls a partial vacuum under the large diameter of the ram and the top of the lower cylinder. The ram first uncovers the exhaust-intake ports to blow down the power cylinder. The scavenge ports are then uncovered by the rising ram to allow the partial vacuum under the ram to pull fresh air into the power cylinder. This sweeps burned gasses from power cylinder. As the ram continues to rise, large quantities of fresh air are drawn through the power cylinder to purge it of all burned gasses.

During this time, the ram compresses air in the bounce chamber. When the ram stops rising, gravity and the bounce chamber pressure accelerate the ram downward. As the ram travels it closes off the scavenge ports and intake exhaust ports. Air then trapped in the scavenge cylinder is vented through reed valves on the front of the Hammer. As the ram continues downward it compresses air, fuel is injected and the cycle continues.

When handling and operating, it should be kept in mind that the Pile Hammer is essentially a Diesel Engine and should be afforded the same care and treatment.

HANDLING

Safe handling practices go hand in hand with protection of component parts on this Hammer.

When picking up the Hammer, it must be remembered that the ram is free in the cylinder. For this reason the Hammer should not be picked up with a single hoist line attached to the center of the Hammer.

The use of handling brackets (See Tools) is recommended with lifting chains attached to pick up Hammer at a 45° angle as shown in Fig. 9-2. Lay Hammer down on blocks on the guide angle pads. Handling the Hammer in this manner will insure against damage to fuel and lube system, fuel and lube tank, bounce chamber tank and other vital Hammer parts.

INSTALLATION AND OPERATION

1. Get Hammer on job on cribbing in horizontal position. See Fig. 9-2 for handling Hammer from horizontal position.
   (a) The cylinder head is designed to allow centerline hoisting of the Hammer. The Hammer may be raised from a horizontal position to a standing position using the starting cable. (Do not pull latch release rope when handling the Hammer).

   A lifting eye is provided at the rear of the head. This eye should be used

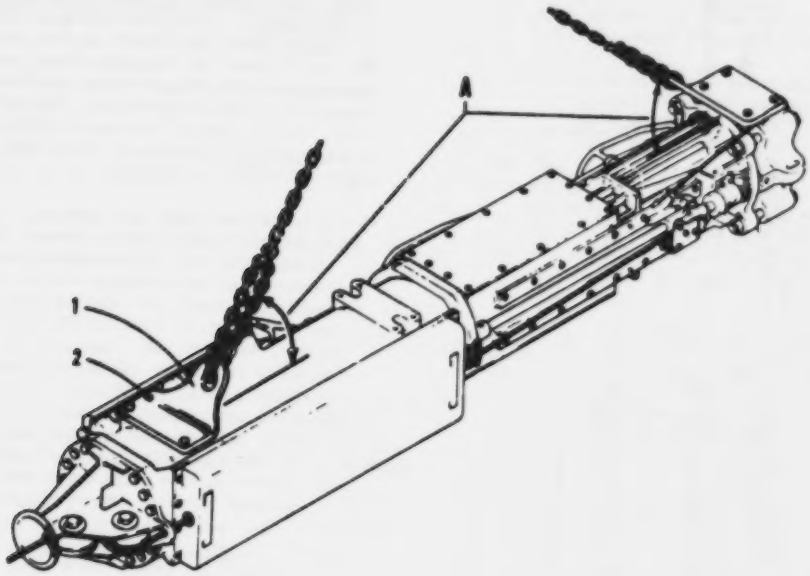


FIG. 9-2

HANDLING DIESEL PILE HAMMER

(A) CHAINS AT 45° ANGLE

(1) HANDLING BRACKETS
(2) CAPSCREWS & LOCKWASHERS

when it is necessary to make heavy lifts, such as removing stuck mandrels from tube piling, using the Hammer. This offers protection to the lifting mechanism while making these heavy lifts.

Low overhead clearance in short leads sometimes make it desirable to install the hoist cable direct to the starting device. Standard starting cable is 7/8" dia.. Minimum size cable which may be used is 3/4" dia. See Section J2 for operating lead lengths and cable specifications. See cable reeving, Fig. 9-3.

(b) Pick up the Hammer carefully. Prevent it from spinning or rotating while suspended on the hoist cable.

2. Install Hammer in leads.
   (a) Refer to Section 4 for box section type guide angle or "H" beam type clip installations.

3. Cable adapter assembly and driving head to anvil retainer. (Refer to Fig. 9-1). When stacking components of the recoil dampener adapter assembly, thread eye bolt into cushion adapter cap to make crane lift.
   (a) Refer to Section 4. A driving head or fillers are required to drive any piling.
   (b) Make sure the driving head or fillers are the type recommended for the pile to be driven.

STARTING CABLE REEVING

The capacity of the lifting crane must be adequate to permit single hoist line cable reeving to the starting mechanism.

Multiple cable reeving may retard the descent of the ram and starting problems will result.

INTAKE-EXHAUST PORTS

A relatively large bounce chamber tank, Fig. 9-1, is located outside the upper cylinder and is connected to the cylinder by ports. This tank stores the air compressed by the ram which results in nearly double the number of blows per minute from the Hammer.

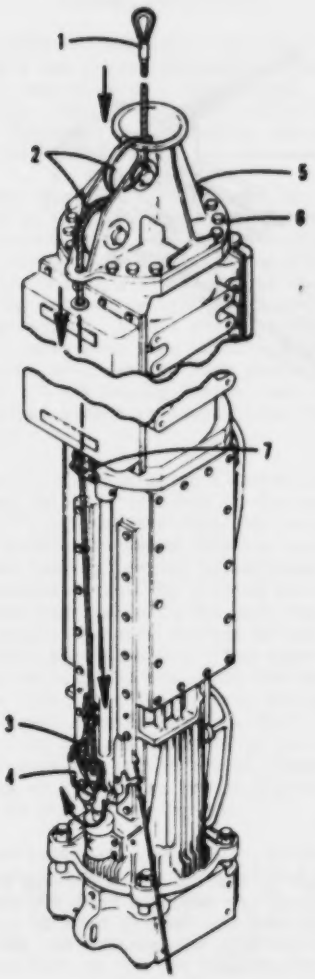


FIG. 9-3

CABLE AND REEVING

→ = CABLE REEVING DIRECTION

(1) STARTING CABLE ASSEMBLY
(2) SHEAVES
(3) "J" BOLT
(4) LATCH BLOCK COVER
(5) LIFTING EYE
(6) CYLINDER HEAD
(7) CABLE GUIDE

The intake-exhaust ports perform a dual function allowing exhaust gasses to be expelled from the power cylinder, and fresh air to enter cylinder for fuel injector mixture to provide next power stroke.

The intake-exhaust ports and bounce vent port are equipped with removable covers Fig. 9-4. These covers must be removed prior to operation of the Hammer. They should be used to cover the ports when the Hammer is not in operation. The latter must be done to afford maximum protection from the elements or foreign matter, especially when transporting the Hammer. The ports should always be covered when the Hammer is idle for any length of time such as overnight or while in storage.

4. Fill fuel and lube oil tanks.
   (a) Refer to Lubrication Chart, Section 10, for fuel oil recommendations.
   (b) Refer to Lubrication Chart, Section 10, for lube oil recommendations.
5. Install throttle control (Hydraulic Transmitter, See Section 11).
   (a) Fill reservoir (Refer to Lubrication Chart, Section 10).
   (b) Make sure hoses are full of oil and bleed the system at the receiver. (Refer to Bleeding the System, Section 11).
   (c) Remove bounce vent cover and intake-exhaust covers. See Fig. 9-4.

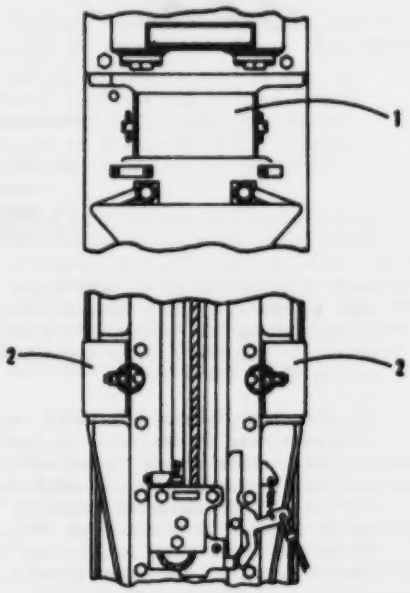


FIG. 9-4

REMOVABLE COVERS

(1) BOUNCE VENT COVER
(2) INTAKE-EXHAUST COVERS

6. Check out fuel system. (Refer to Fuel Injection System, Section 11).
   (a) Remove cover plate between lube pumps.
   (b) Raise ram 17" (This will raise cam surface from fuel pump bell crank).
   (c) Lock hoist brake.
   (d) Open throttle. Observe fuel pump rack operation. (Refer to Fuel Injection Pump, Section 11).
   (e) Insert small diameter end of priming lever in bell crank at point "A" Fig. 9-1.
   (f) Hand operate fuel pump until heavy resistance is felt, then jerk down on lever to pop injector. (Injector should make loud squeaking noise).
   (g) Check, timing. (See Fuel Pump Timing, Section 11).
7. Check lube system.
   (a) Ram raised 17".
   (b) Throttle control in off position.
   (c) Remove pipe plug from right lube pump. (Refer to Lube Pump Bleeding Section 11).
   (d) Let approx. 1/8 pint lube oil flow through, (oil free of air).
   (e) Reinstall plug.
   (f) Follow same procedure for left lube pump.
   (g) Disconnect two lube lines at fittings into upper and lower cylinders.
   (h) Manually operate bell crank with priming lever until oil flows from ends of both lube lines.
   (i) Output adjustment. (Refer to Lube Pump Output Section 11).
      (1) Drop ram with fuel off (lube lines to upper and lower cylinders disconnected).
      (2) Adjust pump flow to one drop per stroke.
         (a) To increase flow, remove shims from beneath lube pumps.
         (b) To decrease flow add shims.
      (3) Reconnect lines to cylinder fittings.

> NOTE: Left-hand lube pump lubricates upper cylinder. There is a check valve in elbow at entrance to cylinder. Right lube pump lubricates lower cylinder. A check valve is located at the pump.

8. Check fluid level of dash pot, with starting device raised. Refer to Lubrication Chart, Section 10. The dash pot assembly acts as a cushion for the push rod return when the ram is dropped, for starting and as a shock absorber for the starting mechanism while the Hammer is driving. (Refer to Dash Pot Assembly, Section 11).

9. Hammer start. To start the Hammer use the following procedures:
   (a) Lift Hammer in leads to proper height.
      (1) Make sure throttle hose is clear of leads.
      (2) Make sure latch release rope is properly installed and is clear as Hammer is raised. Refer to Fig. 9-5.
   (b) Set pile under Hammer and driving head. It is important that the entire weight of the Hammer is bearing on the pile so the anvil is in the "up" position.
   (c) Set Hammer and driving head on pile and release all tension in crane hoist line.

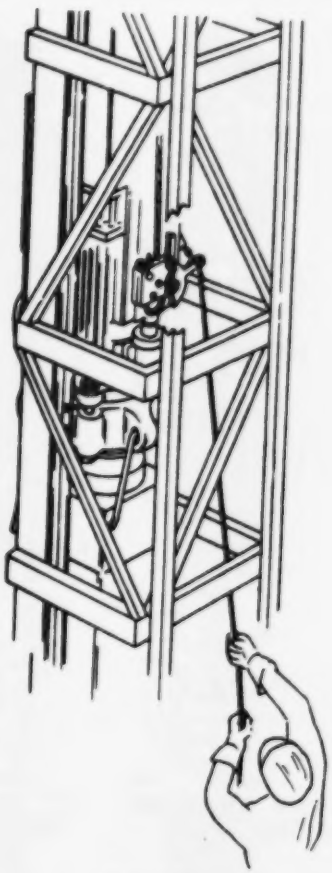


FIG. 9-5

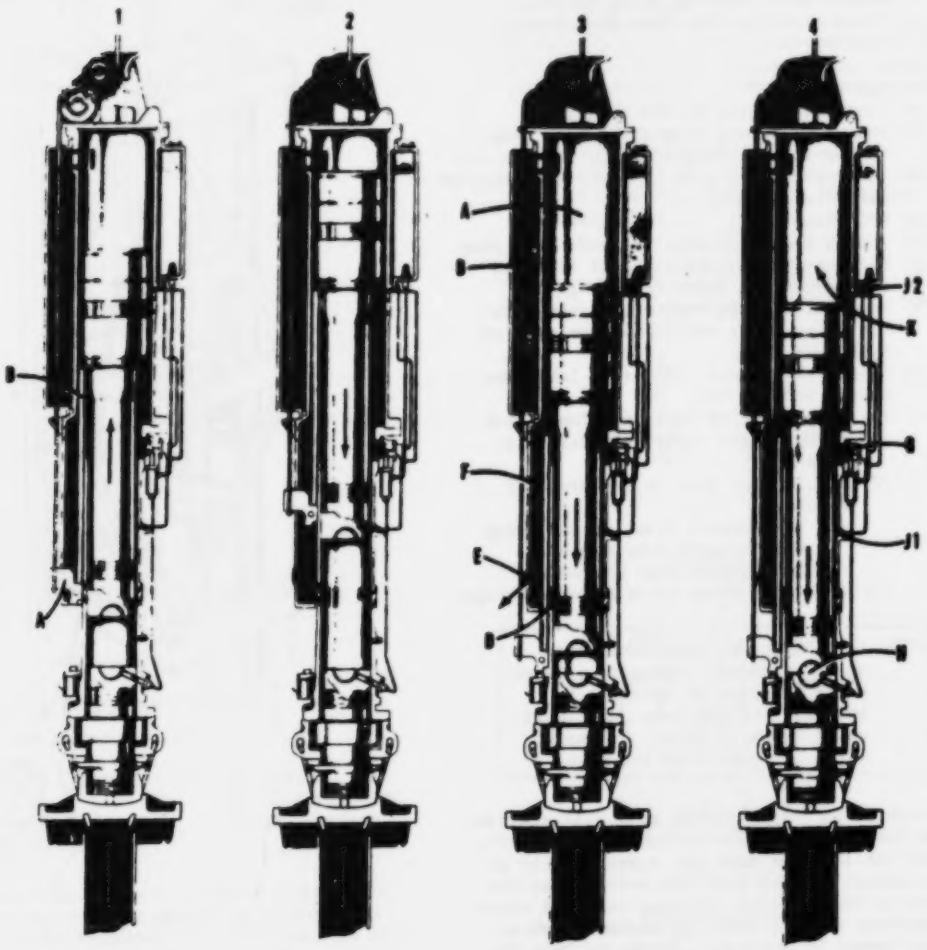
PULLING LATCH RELEASE ROPE

(d) Set throttle at 1/2 position. It is advisable to run and warm up the Hammer at part throttle.
(e) Pull down on latch release rope fully and hold (by ground crew). Refer to Fig. 9-5.
(f) Crane operator can now engage hoist clutch and lift the ram to top of stroke.
(g) To release ram, stop upward movement and release hoist, letting ram drop in cylinder.

CAUTION:	Do not hold ram at top of stroke but lift and drop as quickly as possible.

10. Control of Hammer while driving pile.
    (a) The throttle control should not be full on when starting the Hammer for the first time.
    (b) After the Hammer is started, the throttle can be advanced to full on in soft driving.

HAMMER OPERATING CYCLE SEQUENCE



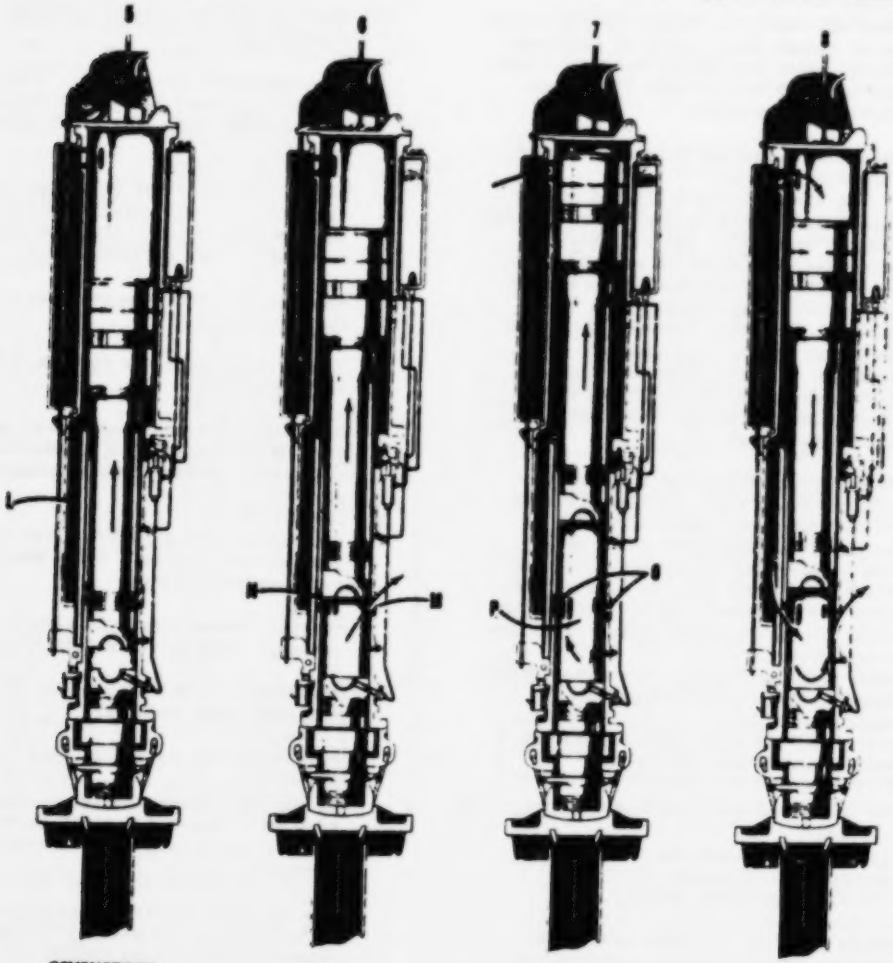
LIFTING RELEASE COMPRESSION INJECTION-IMPACT

(c) If the Hammer is on a free moving pile, or just starting a pile, the crane operator must watch the cable to keep slack in it. Otherwise, as the Hammer drives the pile downward, the cable will tighten until it is supporting the Hammer. This will cause the Hammer to stop and subject entire output of Hammer to crane Hoist line, boom and hoisting machinery.

(d) As pile tightens up and Hammer starts to "rack" throttle should be backed off.

(e) Keep Hammer on top of pile. Prevent leaping or racking. The limit of the Hammer energy rating capacity is evident when the Hammer cylinder begins to raise off the anvil or pile. The Hammer should not be required to drive more than 10 to 20 blows to the inch and then only for short periods of time and when checking bearing value, depending upon soil conditions and type of piling.

Abusive damage can result if the Hammer is allowed to bounce or jump off (rack) on the pile while in operation. The term "rack" is commonly used by pile driving personnel to define excessive bounce or jumping of a Pile Hammer dur-



COMBUSTION EXHAUST SCAVENGING PURGING

ing the driving operation. "Rack" is caused by allowing the ram to rise too far causing the entire Hammer to jump off the pile. In the case of most Steam or Air Hammers and other Diesel Hammers, solid contact is made by the ram with solid stops which are built into the Hammers.

In the case of the Link-Belt Speeder Diesel Pile Hammer, air pressure is used as a stop. When the air pressure becomes great enough to counter-balance the weight of the cylinder, the entire Hammer will "rack" or jump noticeably.

Rack can result in damage to any Hammer as it causes shock loads to component parts. When the Hammer begins to rack, the operator should back off on the throttle immediately.

When the Equivalent Output "MF" Energy Indicator is used,
the air pressure indicated on the gauge can be used as a guide to prevent Hammer "racking". The air pressure indicator should not be allowed to go beyond the pressure needed to achieve the maximum output energy for the Hammer. The chart furnished with the indicator can be used to check this pressure. If the gauge indicates pressures beyond those needed for maximum output energy, the throttle should be backed off.

When driving piling on a batter it will be found that the Hammer starts to lift at lower gauge pressures as compared to driving on plumb piling. The greater the batter the lower the pressure. Since this is normal, more care must be exercised to back off the throttle control when batter piles are being driven.

(f) When required bearing is reached, shut Hammer off by closing throttle.

FOR EMERGENCY STOP ONLY - HOIST THE ENTIRE HAMMER OFF THE PILING

11. Hammer Operating Cycle Sequence (See page 9-6)

1. LIFTING
Latching mechanism (A) unlocked by ground rope (See page 11-7 for latching mechanism detail).

Hoist push rod (B) with crane line (Crane line travels through conduit in compression tank).

Push rod contacts step in the ram - ram is lifted.

2. RELEASE
Slack off on crane line
Push-rod and ram fall
Push-rod latching mechanism returns to spring-applied lock position

3. COMPRESSION
Compressed air in the upper cylinder (A) and compression tank (B) expands, accelerating ram downward.

Intake-exhaust port (C) and scavenge port (D) are closed by ram, cutting off air supply to lower cylinder.

Reed valves (E) exhaust scavenge chamber (E).

Ram compresses air. Anvil, adapter and driving head tighten on the piling. (Compression also starts the pile in motion).

4. INJECTION - IMPACT
Cam roller (G) rides up on ram camming surface, activating both the fuel and two lube pumps. Atomized fuel injection (H). Lube injection ($J_1 J_2$).

Ram impacts anvil simultaneously with fuel injection.

Highly compressed air ignites from fuel injection.

Upper cylinder and compression tank returns to atmospheric pressure as ram clears bounce chamber exhaust port (K).

5. COMBUSTION
Combustion occurs, driving ram upward. (Combustion creates a bonus downward force on the piling).

Partial vacuum starts forming in scavenge chamber (L) as ram rises.

Cam roller rides down on ram, fuel and lube pumps recharge.

Push rod stays locked in "down" position.

6. EXHAUST
As the ram clears the intake-exhaust port (M), compressed gases expand, rushing out to the lower atmospheric pressure.

The ram then clears the scavenge ports (N), breaking the partial vacuum and permitting remaining compressed exhaust gases to enter.

Air begins to compress above the ram in the upper cylinder and compression tank.

7. SCAVENGING
Fresh air is drawn in through intake-exhaust (O) and ported down across the anvil face, forcing remaining gases up through the scavenge chamber (P).

In the upper cylinder, the ram closes off ports (Q) to compression tank and is halted by air compression against the cylinder top. (This condition represents the extreme ram stroke).

8. PURGING
Compressed air in upper cylinder and compression tank, which stopped the ram's ascent, accelerates the ram downward.

Air rushes ahead of the step in the ram, through the scavenge chamber, and is ported down across the anvil face forcing any remaining exhaust gas out the intake-exhaust port.

Complete cycle repeats 86-90 times per minute.

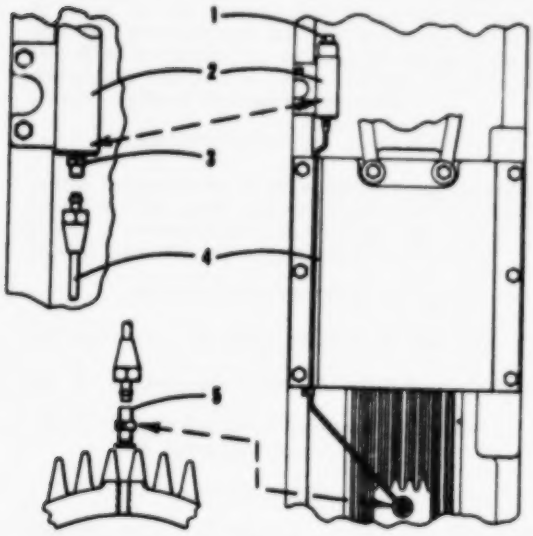


FIG. 9-6
STARTING FLUID INJECTION SYSTEM

(1) CAP
(2) TANK
(3) SCREEN
(4) TUBE
(5) INJECTOR

STARTING FLUID INJECTOR

As an aid to starting the Hammer during cold weather operation and on soft piling, a starting fluid injector is installed.

Fluid placed in the starting fluid injector tank Fig. 9-6, is deposited automatically into the combustion chamber through a spring loaded check valve which is operated by vacuum created when the ram is raised for starting.

KEEP THE FOLLOWING IN MIND REGARDING STARTING FLUID:

(I) Use commercial starting fluid from pour type cans. Approximately four ounces of starting fluid is required to fill the system.

(II) Do not smoke when filling the tank. Be sure no sparks or flames from welding, etc. are present in area when filling tank.

(III) Never fill tank when Hammer is at operating temperature.

(IV) Avoid spilling starting fluid on hands or clothing, especially during cold weather. The starting fluid evaporates rapidly, with consequent cooling which can cause severe frost bite.

COLD WEATHER OPERATION

In addition to using the Starting Fluid Injector previously explained, the following points may be helpful for cold weather starting and running:

(I) Start the Hammer on a partially driven piling. During extremely cold weather temperatures, run the Hammer at part throttle, near idle, until it reaches operating temperatures.

(II) Below zero weather calls for particular care so that the Hammer is gradually brought up to operating temperature before submitting it to the shock loadings of full driving force.

(III) Adherence to specifications for oils as indicated on the Lubrication Chart, Section 10, is particularly important; also, diligence in checking the condition of the injector more often as instructed under Fuel Injector, Section 11, pays off in easier starts and trouble free running time.

GOOD HAMMER OPERATION DEPENDS ON:

SUFFICIENT COMPRESSION FOR IGNITION
GOOD FUEL INJECTED INTO THE COMBUSTION CHAMBER - PROPER QUANTITY OF FUEL AT THE PROPER TIME

DIESEL FUEL OIL SPECIFICATIONS

Always specify Diesel fuel. Do not specify fuel oil.

No. 1 Diesel Fuel
NOTE: Use a straight run No. 1 Diesel fuel with a low sulphur content for all operations except those noted below.

Kerosene - Straight kerosene. Do not add lube oil. To be used for cold weather operation or for starting and running in soft driving conditions. Also to be used where smoke is a problem.
Kerosene is also recommended where No. 1 Diesel fuel quality is questionable.

LUBE OIL SPECIFICATIONS

Above 32°F. - SAE 30 Supplement 1 (S-1) lube oil.
0°F. to 32°F.- SAE 20 Supplement 1 (S-1) lube oil.
Below 0°F. - SAE 10 Supplement 1 (S-1) lube oil.

NOTE: Lube oil must conform to MIL-L-2104-B specification with less than 0.60% by weight of sulphated ash.

A hammer which is operated at "full throttle" produces a dark heavy smoky exhaust in soft driving conditions. This heavy exhaust is caused by partially burned fuel in the combustion chamber. The partially burned fuel turns to carbon.

To clear up the exhaust and reduce the carbon deposit the customer and operator must be cautioned to back-off on the throttle until the exhaust clears up. This will not noticeably affect the hammer driving ability, but it greatly reduces the carbon deposit.

GREASE SPECIFICATIONS - SEE NOTE 1

Grease recommended is of a non-melting characteristic having a drop point not less than 450°F. NLGI number 1 grease should be used giving 3 to 4 strokes per fitting every hours.

STARTING FLUID SPECIFICATIONS

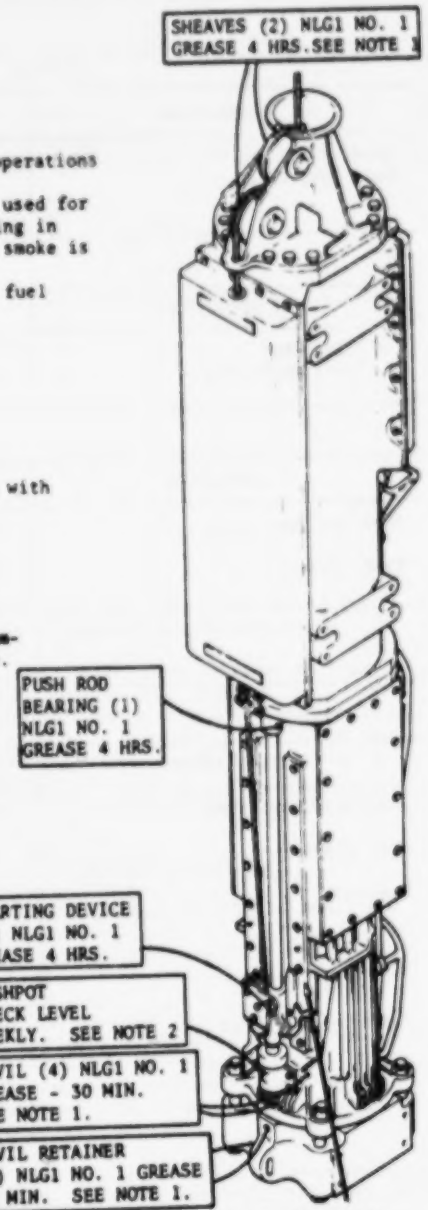
Use commercial starting fluid from pour type cans.

NOTE 1: Corresponds to MIL-L-25013 Specification.

NOTE 2: "Controloyle" - Conforms to MIL-O-5606 Specification.

CAPACITIES

FUEL OIL TANK - 13 GAL.
LUBE OIL TANK - 1.8 GAL.
HYDRAULIC CONTROL SYSTEM (APPROX.)
3 PINTS - SEE NOTE 2
STARTING FLUID TANK - 4 oz.
DASH POT - 1 PINT (See Note 2)



Fill lube oil and fuel tanks at the end of each day's operation. A partially filled tank induces condensation resulting in ice formation in cold weather. At low temperatures, oil may be too heavy to properly flow to the pump; if so, drain and flush tank and replace with lighter oil.

30 MINUTES

OPERATION	REMARKS
Anvil Lube Inspection	Grease anvil and anvil retainer fittings. Observe ram and cylinder walls to make sure that they are well lubricated and adjust lube pumps as required.

EVERY 4 HOURS

OPERATION	REMARKS
Cylinder Head Starting Mechanism	Grease the 2 sheaves in the cylinder head. Lubricate latch block and push rod bearing.

DAILY

OPERATION	REMARKS
Fuel and Lube Tanks	Fill fuel and lube oil tanks at end of each day's operation.
Port Covers	Remove the 3 port covers before starting and replace at end of each day.
General	Visually inspect all parts, nuts, and bolts for looseness and make necessary corrections. See Torque Chart (Section 13).

WEEKLY

OPERATION	REMARKS
Fuel Injection Pump	On new Hammer and/or installation of new fuel pump, execute pump timing procedure and retime as specified.
Wear Rings	Inspect 2 bronze wear rings through ports - replace if vertical machined grooves have disappeared.
General	Check all parts, nuts and bolts for looseness and tighten if necessary. See Torque Chart. Replace damaged or missing grommets or capscrews holding fuel and lube lines in place. Drain bounce chamber of accumulated oil. Drain side tanks of accumulated oil.
Starting Mechanism	Check all cables and starting mechanism for wear and defects. Tighten cable retainer bolts. Replace starting cable if any broken strand wires is observed. Lightly oil the starting mechanism ways and the fuel pump rack and return spring device. Check fluid level in the starting device dashpot tank - fluid should just run out side plug - fill if required.
Recoil Dampener	Replace recoil dampener if thickness is less than specified.
Recoil Dampener Adapter	Replace 5 plastic discs and 4 aluminum discs in adapter assembly if distance between cushion adapter plug and adapter is less then specified.
Fuel Filter	Replace fuel filter element the first week of operation of new hammer. Replace monthly thereafter.

MONTHLY

OPERATION	REMARKS
Fuel Filter	Replace fuel filter element.
Lube Filter	Wash lube oil filter in clean fuel oil.
Fuel Injector Nozzle	Replace injection nozzle as required for good Hammer operation.
Fuel Injection Pump	Execute timing procedure. Retime as specified.

EVERY 3 MONTHS

OPERATION	REMARKS
Reed Valves	Remove and clean with putty knife. Avoid scoring or scratching.

STORAGE OF HAMMER

The following procedure is outlined and should be adhered to, to insure safe Hammer storage:

(a) Remove any one of the pipe plugs from cylinder head and pour in one quart of SAE 30 lube oil to insure a protective lubricating film for top cylinder and ram. Replace plug.
(b) Bounce chamber vent port cover should be on.
(c) Special precautions should be taken with the fuel pump and injector if the Hammer will be idle for a month or more. To prevent corrosion or gumming during the shutdown period, drain the fuel and lube oil tanks by removing drain plugs from filters and disconnect the fuel supply hose from the bottom of the fuel tank.
(d) Raise the ram 17" and open the fuel pump rack, disconnect the high pressure tube at the fuel injector and hand operate the fuel pump to remove fuel oil from injector system.
(e) Fill a clean squirt type oil can with Flushing Oil (Calibrating Oil) and refill the supply hose. Continue operating the fuel pump until the flushing oil is pumped through the tubing.
(f) Reconnect the high pressure tube to the injector and, keeping the fuel pump supply hose full of flushing oil, continue to hand operate the fuel pump. 15 strokes should be sufficient to replace fuel inside of injector with flushing oil.
(g) Refill supply hose with flushing oil and attach to fuel tank.
(h) Squirt lube oil through intake-exhaust ports and secure intake-exhaust port covers.
(i) Lubricate all grease fittings on lower cylinder, and anvil retainer.
(j) Store the Hammer in a horizontal position on timbers or a skid placed against the guide angle pads on the side of the Hammer.
(k) Cover all openings with oil soaked rags or grease.
    (1) Push rods
    (2) Starting device ways
    (3) Reed valves
    (4) Base of Hammer (bottom of anvil and anvil retainer)
    (5) Coat fuel pump rack and control receiver with rust preventative grease and wrap
    (6) Coat dash pot plunger and starting device locking pin with rust preventative. Grease and wrap.
(l) Cover the entire Hammer with a tarp or other protective covering, especially if stored outside.

Before putting the Hammer back into operation, the filters should be removed. The fuel filter should be changed and the lube oil filter should be washed. This will also drain condensation from the lube and fuel oil tanks.

STORAGE OF DIESEL FUEL

The importance of maintaining clean fuel for successful Hammer operation and to prolong the life of the fuel pump and injector cannot be stressed too much. The best fuel can be rendered unsatisfactory by poor storage facilities and careless handling.

Improperly constructed and unvented storage containers can contain water, dirt and sediments. Fuel delivery can cause these contaminents to be agitated and mixed with the fuel.

A properly constructed storage tank should be vented and equipped with a water drain valve. Since natural settling is an effective method of cleaning fuel, the fuel should be allowed to stand 24 hours in the storage tank, if possible, before it is used. The drain valve should be used often and always before each fuel delivery to drain out water and sediment.

Lifting eyes can be added if a portable tank is desired. The tank should be constructed of black iron or terne plate; never use galvanized iron tanks.

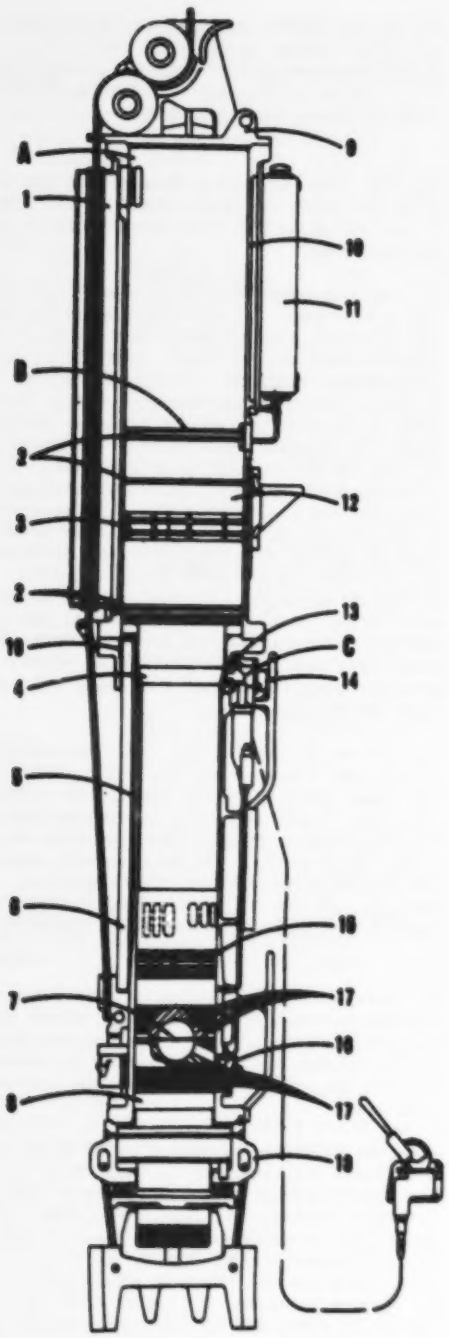


FIG. 11-1

MODEL 440 DIESEL PILE HAMMER

(A) SAFETY SPACE
(B) TAPPED HOLE FOR LIFTING EYE
(C) RECESS FOR PRIMING LEVER

(1) BOUNCE CHAMBER TANK
(2) COMPRESSION RINGS
(3) WEAR RING
(4) CAM SURFACE
(5) LOWER CYLINDER
(6) PUSH ROD
(7) COMBUSTION CHAMBER
(8) ANVIL
(9) CYLINDER HEAD
(10) UPPER CYLINDER
(11) FUEL & LUBE TANK
(12) RAM
(13) CAM ROLLER
(14) LUBE OIL PUMPS
(15) WEAR RING
(16) INJECTOR
(17) COMPRESSION RINGS
(18) ANVIL RETAINER
(19) PUSH ROD BEARING

CYLINDER HEAD Figure 11-1

The unique design of the cylinder head and sheave arrangement allows center line hoisting of the Hammer for pile positioning and center line hoist for starting Hammer operation. A bell shaped top opening minimizes cable wear when handling the Hammer.

A lifting eye is provided at the rear of the head. This eye should be used when it is necessary to make heavy lifts, such as removing stuck mandrels from tube piling.

The cylinder head also seals the cylinder for air compression and protects the cylinder bore from the elements and any foreign matter which may drop from the crane boom and cables. The cylinder head sheaves are equipped with replaceable bushings.

REMOVAL OF HEAD FROM CYLINDER

(a) Remove tie wire from head bolts.
(b) Remove head bolts.
(c) Remove cylinder head.
(d) Inspect sheaves for wear and replace sheaves or bushings as necessary.

Replace cylinder head by reversing the above procedure. Install new head gasket. Refer to Torque Chart, Section 13 for torque recommendations on head bolts.

CYLINDER

The cylinder is manufactured in two parts, the upper cylinder and lower cylinder Fig. 11-1. An area which is called the safety space (A), is located between the cylinder head and the bounce chamber tank ports. This area keeps the ram from striking the cylinder head as total compression would have to be overcome for it to do so. The entire cylinder will noticeably begin to lift, or rack, when the ram enters this safety space. The output energy rating device, Section 8, can be used to determine the condition of the cylinder walls, compression rings, and air leaks.

If erratic operation and excessive lifting of the Hammer is evident, it may be due to excess upper cylinder bore wear, worn compression rings, damaged or leaking bounce chamber tank or cylinder head. The maximum wear allowable on the upper cylinder bore is 18.030". If wear goes beyond this, replating or replacement will be necessary. Loss of compression and power may also be due to excess lower cylinder bore wear. Maximum wear allowable on the lower cylinder bore is to 12.030".

Follow the method for Removal of Ram From Cylinder. Using an 18" plus micrometer, check the upper cylinder bore diameter for wear. Using a 12" plus micrometer, check the lower cylinder bore for wear.

RAM

The ram, Fig. 11-1 is a free piston and is the means by which the work output of the Hammer is delivered to the pile thru the anvil and driving head.

The ram has compression and wear rings on both top and bottom. On the very top of the ram are two ring grooves which contain the bounce chamber compression rings. Just below these compression rings is a wider ring groove which contains the upper bronze wear ring. This ring is 4" wide and 18" in diameter and provides the surface which guides the upper part of the ram within the upper cylinder. This ring has both vertical and horizontal oil distribution grooves which aid in maintaining a film of oil on its surface. WHEN THESE GROOVES BECOME WORN SMOOTH OR ARE ELIMINATED AT ANY POINT ON THE WEAR RING, THE RING SHOULD BE REPLACED. If replacement is not made under the above circumstances, the ram surface will contact the cylinder bore causing rapid wear and resulting in major repair. Located below the bronze wear ring are two more compression rings.

The bottom of the ram has four compression rings, and a wear ring, Fig. 11-1, which guide the lower portion of the ram in the lower cylinder. This wear ring is located above the compression rings. The condition of the sight check grooves can be observed through the intake-exhaust ports. As explained earlier, should any of the ring grooves wear smooth, the wear ring should be replaced.

REED VALVES

The self-scavenging system on this Hammer creates internal air turbulence, which clears the cylinder of exhaust gasses on the upstroke of the ram, when a vacuum is developed to draw the burned gasses from the combustion area.

When the ram travels upward after combustion, the intake exhaust port is cleared first. The burned gasses blow out of these ports. The four reed valves, Fig. 11-2, flap shut due to the partial vacuum in the scavenge chamber caused by the rising ram. When scavenge ports are cleared, fresh air is drawn into the lower cylinder, down across the anvil face, and up through the scavenge chamber into the upper cylinder.

When the ram begins its down stroke, this highly diluted air then rushes ahead of the ram, through the scavenge chamber, down across the anvil face, and up through the intake exhaust ports, further scavenging the cylinder. At this time, the reed valves are open to exhaust the scavenge chamber.

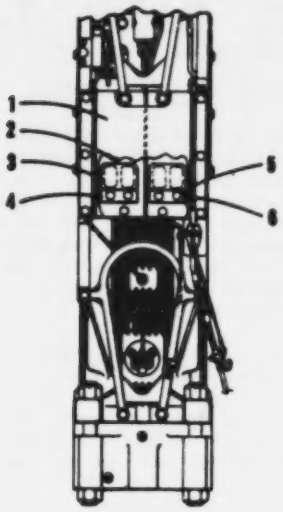


FIG. 11-2

REED VALVES

(1) SHROUD
(2) AIR VALVE PLATE ASSY.
(3) REED
(4) REED RETAINER
(5) LOCK PLATE
(6) CAPSCREW

The reed valves should be inspected every three months and cleaned as necessary by proceeding as follows:

(a) Remove shroud.
(b) Remove air valve plate assembly and clean as necessary with solvent to remove all grit and carbon deposits.
(c) Remove reeds and clean as necessary. A putty knife and solvent may be used to clean reeds. Avoid use of any sharp tools or scrapers which could scratch reed seating surfaces and cause air leaks.

Air leakage past the reed valves will result in incomplete scavenging and dark puffs of smoke will be noticeable out exhaust. If reeds are scored or etched, they should be replaced. Reeds are machined from select spring steel material and replacement must always be made with standard factory parts only.

Reassembly of Air Valve Plate Assembly:
(a) Clean scavenge chamber in cylinder.
(b) Assemble reeds on air valve plate with retainers, capscrews and lock plates. Refer to Fig. 11-2.
(c) Tighten capscrews to value shown on torque chart. Bend lock plates over capscrew heads.
(d) Install air valve plate assembly with new gasket.
(e) Assemble air valve plate assembly on Hammer with lockwashers and capscrews. Tighten capscrews per torque chart.
(f) Install shroud and tighten capscrews per torque chart.

Removal of Ram From Cylinder.

To remove ram from the cylinder:
(a) Disconnect and plug lube and fuel lines.
(b) Remove the cylinder head (Refer to Removal of Head From Cylinder).
(c) Install lifting eye bolt in ram at (B), Fig. 11-1, and lock with jam nut. (To enable easier eyebolt installation ram can be raised using lifting device).
(d) Attach hoisting line to eyebolt and lift ram from cylinder. A means should be provided to prevent ram from spinning with possible loosening of eyebolt and unravelling of cable when ram is removed from cylinder.

The push rod bearing Fig. 11-1, should be inspected for wear and replaced if necessary whenever the ram is removed. (Refer to PUSH ROD BEARING).

To install ram in the cylinder:

> NOTE: When reassembling the Hammer, it is a good practice to have the covers on to prevent getting foreign material, especially nuts and bolts, into the Hammer cylinder.

(a) Lubricate the ram liberally with grease.
(b) Lift ram with the hoist line using the eye bolt and jam nut and install in cylinder. A ring compressor is not needed for ram compression rings, since top end of cylinder is tapered to allow gradual compression of these rings.

NOTE: When installing ram in cylinder fuel-lube pump cam roller and lever should be held out of way of ram using hand priming lever. (See Lube Pump Bleeding).

(c) When top of the ram is half way down in top half of cylinder, check the fuel pump timing mark. (Make sure it is not out of top of window). See Fuel Pump Timing.
(d) When the ram is all the way down to the anvil, again check timing of fuel pump. THE FUEL PUMP TIMING MARK SHOULD AT NO TIME DURING HAMMER OPERATION STROKE LEAVE THE TIMING WINDOW COMPLETELY.
(e) Remove the eyebolt from the ram.
(f) Install head gasket and cylinder head.
(g) Replace and tighten head bolts evenly. Uneven tightening could cause leakage at the cylinder head gasket. Cylinder head bolts should be tightened as recommended on the Torque Chart Section 13.
(h) Wire tie cylinder head bolts in place.

Use the following procedure when field installation of wear rings, Fig. 11-1, become necessary:
(a) Remove ram from cylinder. (See Removal of Ram From Cylinder).
(b) Remove compression rings using ring expander. Compression rings are removed to enable wear ring installation with a minimum expansion.
(c) Remove old wear ring. If broken, recover broken parts if possible. Check to be sure these particles have not jammed between ram and cylinder, anvil and cylinder, pump drive, air passages or on top of push rod.
(d) Before installation of new wear ring, roll it around the outside of its groove to insure a proper fit.
(e) Check chamfer of I.D. of wear ring to make sure it is adequate to clear the radius in the corners of the groove on the ram.
(f) Make sure O.D. of ram is free of burrs, lubricate surface of ram that the ring will have to slide over, and install wear ring. Under no circumstances should the wear ring be installed or removed without first removing the compression rings. Whenever replacing compression rings, be sure to break all sharp edges which could score the cylinder walls. Do not expand ring anymore than necessary as too much expansion will set up permanent stresses. This could cause point contact of ring O.D. to cylinder and, if excessive, could cause ram seizure to cylinder.
(g) Replace ram in cylinder (See To Install the Ram in Cylinder).

PUSH ROD BEARING

Excessive play of the push rod in the cylinder, indicates a worn bearing.

To replace the push rod bearing Fig. 11-1, it is necessary to separate the upper and lower cylinders. Use a 2" dia. x 12" long rod for removal. Using a piece of wood to avoid damaging bushing drive it into place.

ANVIL AND ANVIL RETAINER

The anvil Fig. 11-1 is located at the bottom of the cylinder and relays the energy, delivered to it, from the ram to the pile. As the ram descends, closing intake-exhaust ports, it compresses air between it and the anvil. The air compression preloads the anvil and pile and is contained between the ram and anvil by means of compression rings located above the flange of the anvil, Fig. 11-3.

Located on top of the anvil is the bottom half of the combustion chamber. The injector sprays atomized fuel into the chamber just prior to the time that the ram strikes the anvil. The residual gases explode and expand, driving the anvil and piling down and the ram upward in the cylinder.

The anvil moves up and down 1 3/8" inside the anvil retainer, Fig. 11-3, and has its movement limited by a flange which is part of the anvil casting. An alignment pin locates the anvil with the anvil retainer to prevent the anvil from turning. The downward travel of the anvil is curtailed by a shoulder which is machined in the anvil retainer. The anvil retainer is located with the lower cylinder by a dowel pin and is held in place by means of anvil retainer bolts.

To Remove Anvil and Anvil Retainer:
(a) The Hammer should be resting on a wood block large enough to hold anvil in its "up" position.
(b) Remove nuts from top of anvil retainer bolts, Fig. 11-3.
(c) Use starting device lifting cable (do not pull latch release rope) and lift the Hammer from anvil and anvil retainer.

To replace the anvil and anvil retainer, reverse the above procedure. A ring compressor is not needed for anvil compression rings since bottom end of the cylinder is tapered to allow gradual compression of these rings.

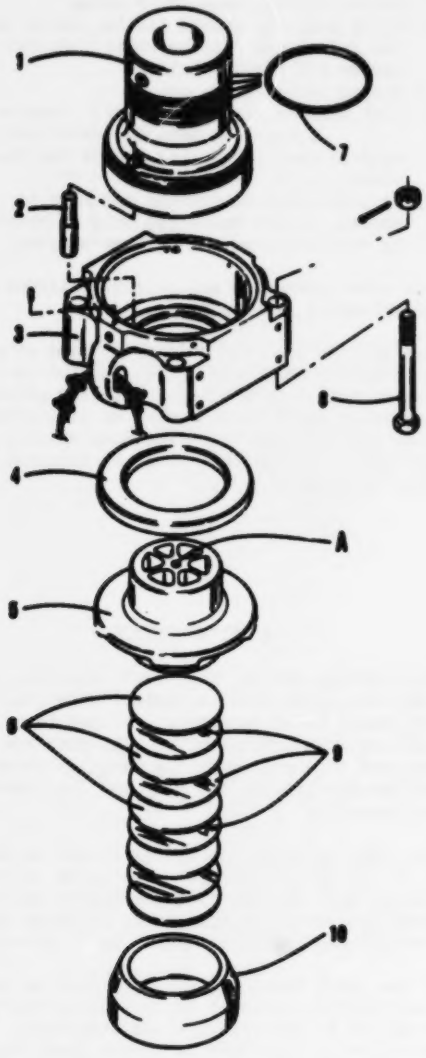


FIG. 11-3

ANVIL AND RECOIL DAMPENER ADAPTER ASSEMBLY

(A) TAPPED HOLE FOR LIFTING EYE

(1) ANVIL
(2) ALIGNMENT PIN
(3) ANVIL RETAINER
(4) RECOIL DAMPENER
(5) CUSHION ADAPTER CAP
(6) PLASTIC DISCS (FIVE)
(7) COMPRESSION RINGS
(8) ANVIL RETAINER BOLTS
(9) ALUMINUM DISCS (FOUR)
(10) ADAPTER

Tighten anvil retainer bolts to the given torque value shown on Torque Chart, Section 13.

After reassembly, and before starting the Hammer, generously lubricate the grease fittings at the bottom of the cylinder and on the anvil retainer using grease as specified on the Lubrication Chart.

RECOIL DAMPENER AND ADAPTER ASSEMBLY

The recoil dampener Fig. 11-3 is of a material that absorbs the shock loadings of the cylinder. It rides on the upper portion of the cushion adapter cap, just below the anvil retainer assembly. The purpose of the recoil dampener is to minimize the effect of shock caused by pile or soil rebound.

The recoil dampener should be checked for wear weekly by measuring the distance (A), between the anvil retainer and the cushion adapter cap, as shown on Fig. 11-4. When dimension (A) becomes 1½" or less, the recoil dampener should be replaced. A new recoil dampener measures 1-3/4" thick.

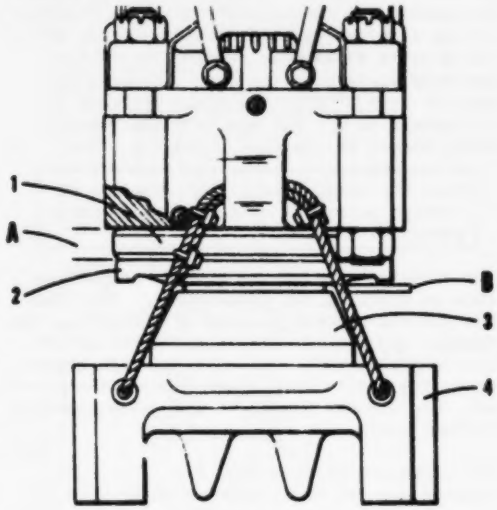


FIG. 11-4

RECOIL DAMPENER, ADAPTER ASSEMBLY AND DRIVING HEAD

(A) RECOIL DAMPENER CHECK DIMENSION = 1½" min.
(B) ADAPTER CHECK DIMENSION = ½" min.

(1) RECOIL DAMPENER
(2) CUSHION ADAPTER CAP
(3) ADAPTER
(4) DRIVING HEAD

To install new recoil dampener:
(a) Rest Hammer on driving head.
(b) Remove driving head cable sling, Fig. 11-4.
(c) Raise Hammer off of recoil dampener adapter assembly and driving head using starting device lifting cable, do not pull latch release rope.
(d) Remove and install recoil dampener. Re-assemble in the reverse order of the above procedure.

The adapter assembly used in conjunction with the driving head consists of a male and female unit. Refer to Figs. 11-3 and 11-4. Five plastic and four aluminum discs are located in this unit. The plastic and aluminum discs are to be alternated, starting out with a plastic disc. The aluminum discs act as a fire wall between the plastic, as high temperatures are generated when driving piling. These temperatures would otherwise burn up the plastic. After proper assembly, the adaptor is placed between the anvil recess and the driving head.

Although the adapter assembly affords protection to the pile, its express purpose is to protect the Hammer. The disc assembly should be checked for compression weekly. Extrusion of the aluminum discs and deterioration of the plastic discs make compression of the assembly visibly noticeable. The original gap (B) is 5/8" with new discs and when it is reduced to ¼", the aluminum and plastic discs should be replaced. See Fig. 11-4.

When the discs become worn, the use of foreign materials such as wood or cable should be avoided.

The addition of discs to already compressed sets of discs is not recommended. The discs are for the express purpose of protecting the Hammer, and already compressed discs afford little protection. For extended life expectancy, the entire disc stack should be replaced. Replacement should be made with standard factory parts.

The clearance between cap, Fig. 11-4, and adapter cap can be measured usually with the assembly in operating position as shown. The use of certain driving heads may not permit taking an accurate measurement to determine amount of wear and it may be necessary to loosen cable sling and lower driving head to take measurement.

To remove disc assemblies and driving head, procedure is as follows:
(a) Rest the Hammer on driving head.
(b) Remove driving head cable sling.
(c) Using starting device lifting cable (do not pull latch release rope) lift the Hammer off driving head.
(d) Remove recoil dampener.
(e) Lift cushion adapter cap off. Eyebolt may be used to crane lift adapter cap. This will expose the disc stack.
(f) If disc stack is crushed and hard to remove, a disc knock-out hole is provided in the bottom of the cushion adapter.

This above procedure may also be followed when interchanging driving heads.

When driving concrete piling, plywood of a satisfactory thickness is recommended as a cushion between the driving head and piling to prevent spalling, however, an excessively thick pad may seriously slow down driving and may affect the bearing values as computed by usual formulas.

STARTING DEVICE

The starting device, Fig. 11-5, consists of a push rod, latch block assembly, wire rope assembly, latch block retainers, release lever, pull rope and dash pot assembly. The push rod is designed to engage with the large diameter of the ram for lifting the ram, and for starting the Hammer.

The latch block pin is spring loaded to hold it in the locked position when using the hoist line to lift and position the Hammer and prevents accidental engagement of the push rod with the ram while the Hammer is in operation.

If the latch block pin will not lock in operating position, or does not release properly, it should be disassembled and inspected. Failure of latch block pin to unlock (push in) with normal pulls on the latch release rope, may indicate lack of lubrication, or pin jammed due to wear or foreign material, or tension in starting rope line. Failure of the pin to lock into operating position may be due to any of these same reasons or to a broken latch block spring.

NOTE: Do not operate Hammer with crane hoist line tight or under tension.

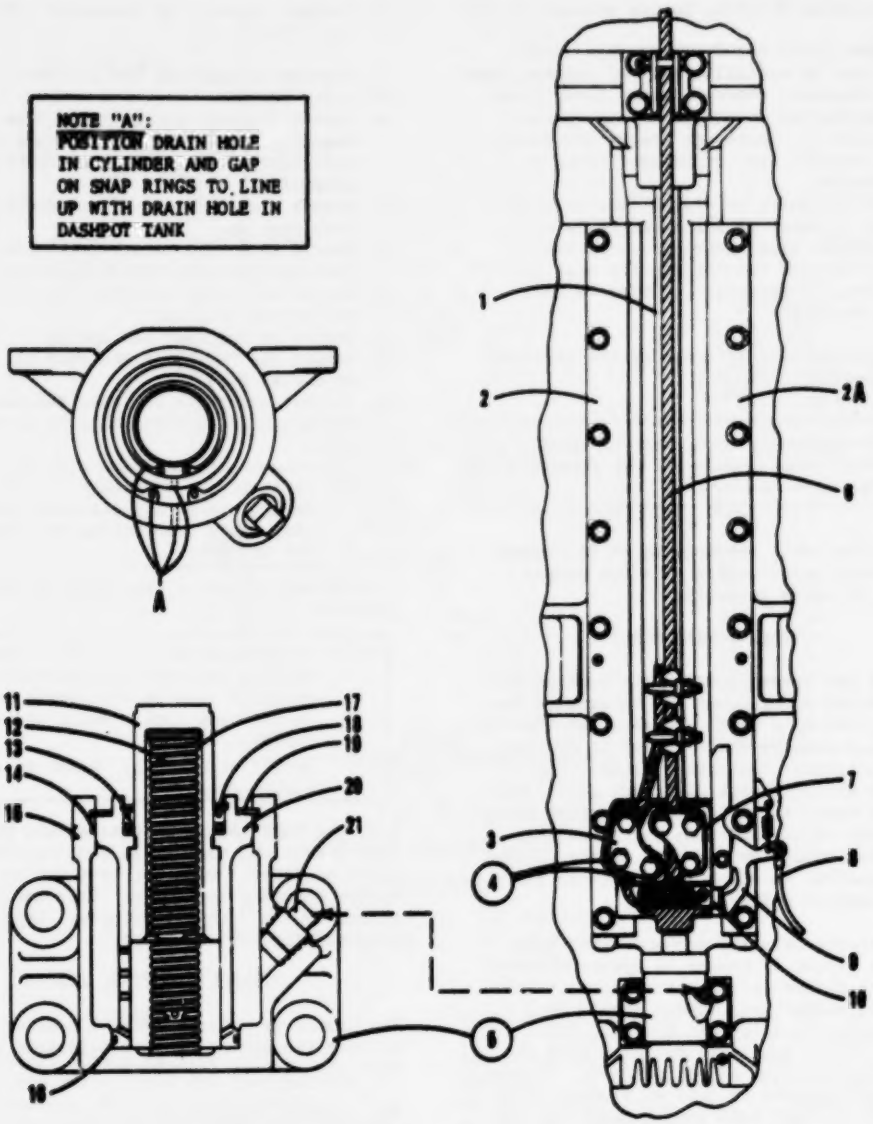


FIG. 11-5

STARTING DEVICE AND DASH POT ASSEMBLY

(1) PUSH ROD	(6) WIRE ROPE ASSEMBLY	(12) SPRING SEAT	(17) SPRING
(2) LATCH BLOCK RETAINER, LEFT HAND	(7) LATCH BLOCK	(13) OIL SEAL	(18) SNAP RING
(2A) LATCH BLOCK RETAINER, RIGHT HAND	(8) LATCH RELEASE ROPE	(14) "O" RING	(19) SNAP RING
(3) LATCH BLOCK COVERS	(9) RELEASE LEVER	(15) DASH POT TANK	(20) CYLINDER
(4) LATCH BLOCK ASSEMBLY	(10) LOCK PIN AND SPRING	(16) "O" RING	(21) PLUG
(5) DASH POT ASSEMBLY	(11) PLUNGER		

To disassemble Starting Device proceed as follows:
(a) Remove latch block covers Fig. 11-5.
(b) If wear or excessive play of release lever is observed, remove release lever pivot capscrew and remove lever and spacer.
(c) Inspect all parts for cracks and damage and replace worn or damaged parts as necessary.
(d) Wash all parts in diesel fuel as dirt, dust or other abrasive materials will sometimes cause improper operation.
(e) Inspect push rod bearing for wear, and replace if necessary. (Refer to Push Rod Bearing).

Reassemble in reverse order of the disassembly procedures:

NOTE: In reassembly make sure to install pin with large chamfer to the outside with spring to inside.

If starting cable assembly is to be removed or replaced refer to Fig. 9-3 for proper reeving of cable assembly.

DASH POT ASSEMBLY

The dash pot assembly acts as a cushion for the push rod return when ram is dropped for starting and as a shock absorber for the starting mechanism while Hammer is driving. It is an air-oil type accumulator. The dash pot piston forces fluid out ports into the tank where air is compressed, cushioning the return of the starting mechanism and permitting enough over-travel of the latching mechanism, to allow it to lock in the spring-applied safety position.

Damage to the starting mechanism and dash pot will result if Hammer is operated with the shock absorbing characteristics of the dash pot ineffective. There should be approximately 1-9/16" maximum dash pot plunger travel available measured with the latch block resting on the plunger. If maximum plunger stroke is lost or plunger fails to return to "up" position, inspect for the following:

(a) Loss of hydraulic fluid. Inspect for loose fill plug. Leakage of fluid around dash pot cylinder or plunger indicates worn "O" rings or oil seal wiper ring, or both.
(b) Broken plunger spring, not permitting plunger to return to full up position.
(c) Dashpot incorrectly assembled. See Fig. 11-5.

To disassemble the Dash Pot proceed in the following manner:
(a) Remove the dash pot assembly from the Hammer. Clean dash pot tank and plunger thoroughly with diesel fuel before disassembly.
(b) Remove plug, Fig. 11-5, and drain fluid from dash pot.
(c) Remove snap ring securing cylinder in dash pot tank and remove cylinder assembly
(d) Remove snap ring securing oil seal assembly within cylinder.
(e) Remove spring seat and spring.
(f) Remove all "O" rings and wash all parts in Diesel fuel.
(g) Inspect all parts for wear and damage. Replace worn or damaged parts as necessary.

NOTE: It is always advisable to install new "O" rings and oil seal wiper ring, when overhauling the dash pot assembly.

Tc reassemble reverse the above disassembly procedure.

NOTE: When reassembling position drain hole in cylinder and gap on snap rings to line up with drain hole in dash pot tank. Refer to position "A" Fig. 11-5.

Refill with fluid. Refer to Lubrication Chart.

Dash pot tank should be checked and filled only when Hammer and tank is in true vertical upright position. Dash pot tank may be refilled before mounting to Hammer. Fill until fluid starts to run from filler hole. Replace fill plug and tighten securely.

HYDRAULIC CONTROL SYSTEM

The Hammer is equipped with a hydraulic control to vary the amount of fuel delivered by the fuel pump to the injector.

The control consists of:
(I) A transmitter Fig. 11-6, which is the master cylinder for the control system and is usually operated by the machine operator.
(II) A double relief valve is mounted directly below the transmitter. This is designed to hold a pressure preloaded head of oil in the control hose.
(III) A length of high pressure hose.
(IV) A receiver is mounted on the Hammer.

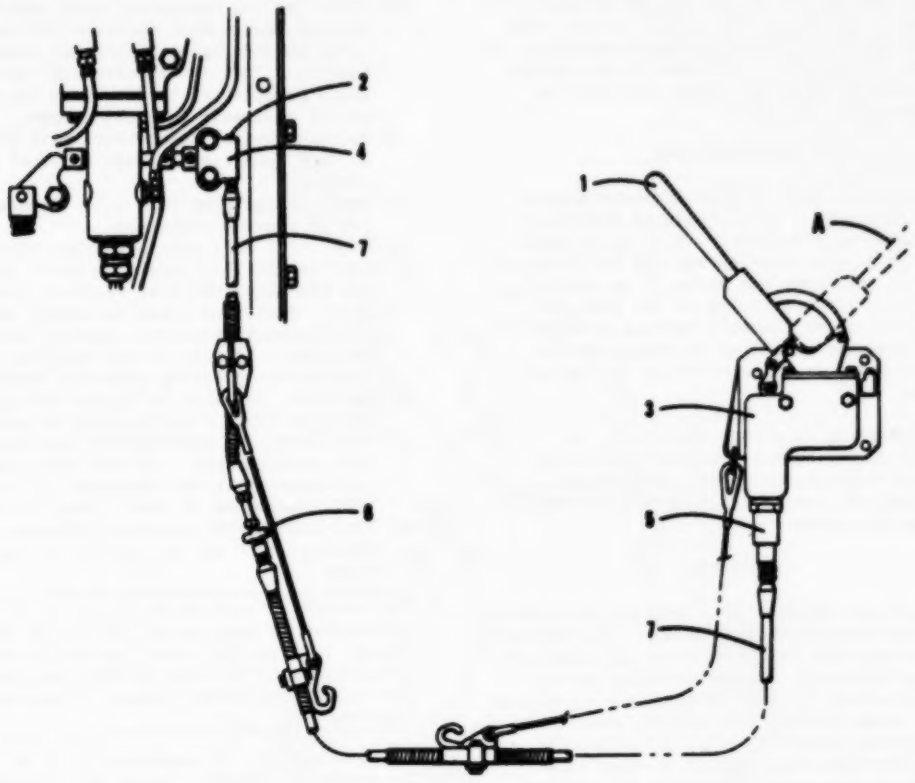


FIG. 11-6

HYDRAULIC CONTROL SYSTEM

(A) SYNCHRONOUS

(1) HANDLE
(2) BLEED PLUG
(3) TRANSMITTER
(4) RECEIVER
(5) DOUBLE RELIEF VALVE
(6) SELF-SEALING COUPLING
(7) HOSE

TRANSMITTER

The transmitter serves as a reservoir for storage of hydraulic fluid and incorporates a piston assembly which meters hydraulic pressure to actuate the fuel pump rack through a receiver, or "slave cylinder", mounted on the Hammer. Operating pressure in the system is variable controlled by the friction type hand lever, which is connected with the piston assembly, Fig. 11-7 mechanical linkage. The transmitter assures a wide range of control of the fuel delivered to the Hammer since the positive friction lever may be set at any desired operating position.

By moving the control lever to the "on" position, a column of oil is moved through the double relief valve through the hose to the receiver. As the receiver piston moves out of its cylinder, Fig. 11-7, it moves the rack on the fuel pump to the "on" position.

DOUBLE RELIEF VALVE

The function of the double relief valve Fig. 11-7 is to keep the control hose full of oil, making it unnecessary to pump up pressure after the transmitter lever is returned to the "off" position. No adjustment of the relief valve is provided. The pre-

loaded head of oil in the system is maintained by springs in the relief valve. The relief valve will maintain approximately 40 lbs. of hydraulic pressure in the system with control valve in either the "off" or "synchronous" position.

HYDRAULIC HOSE

The hydraulic hose is high pressure double wire braid hose. Care should be exercised when handling this hose. If it is allowed to catch on the leads in any way and stretched, high pressures can be built up inside the hose. The stretching of the hose reduces its inside diameter causing a build-up of pressure resulting in damage to the control hose, or other parts of the control system.

A self-sealing coupling, Fig. 11-6, is located on the Hammer, permits removal of the hose without losing oil pressure or admitting air into the system while transporting the Hammer.

RECEIVER

The receiver consists of a housing and a piston which are mounted on the Hammer. The hydraulic hose is attached to the side of the receiver housing cylinder. As the throttle control lever is moved to the "on" position, a column of oil moves through the control hose. The oil pressure moves the receiver piston to engage and open the rack on the fuel pump. Mounted on the opposite side of the Hammer from the receiver is a spring assembly which serves to return the fuel pump rack and receiver piston, closing the fuel pump rack when the hydraulic transmitter lever is moved toward "off" position.

BLEEDING THE SYSTEM

Bleeding the control system should be done by carefully going through the following steps. This procedure should be followed on initial start up:

(a) Make sure all hydraulic hoses are full of oil and connected at Hammer and at double relief valve on transmitter. Tighten all hose connections.
(b) Open breather cap, Fig. 11-7, located on top of transmitter. (Breather cap must be opened before operating and left open during operation). With transmitter lever in "full on" position, fill reservoir through elbow fitting located on side of transmitter, until oil is visible at top of fitting.
(c) After filling reservoir, pull lever all the way back toward operator and hold for a few seconds against internal spring tension. This is "synchronous" position, which permits oil to flow from the transmitter reservoir into the system.
(d) Release control lever which will return to "off" position through internal spring tension.
(e) Remove bleed plug Fig. 11-6, located on top of receiver cylinder.
(f) Move lever back and forth from "synchronous" to "full on" position until all air has been expelled from receiver through hole. Each time prior to moving lever to "synchronous" position, replace and tighten the plug. If plug is not replaced each time prior to moving lever to "synchronous" position, air will be sucked into system and additional bleeding will be necessary.
(g) Move lever to "synchronous" position and then push forward. If full fuel pump rack opening is not obtained, air is still entrapped in line. Repeat step (f).
(h) Fill transmitter reservoir through elbow fitting until oil is visible at top of elbow.

> If system is bled properly, it is no longer necessary to pump up control to get full rack. Transmitter lever can be placed in "synchronous" position without any danger of losing the effectiveness of the control system.

Few problems will be experienced if the hydraulic system is properly cared for. Always use the recommended type of control oil. Make sure control oil and component parts of the system are kept free of contaminents and foreign materials. They hydraulic components in the system are machined to precision tolerances and the presence of water or an abrasive material will appreciably shorten their useful life.

REPLACEMENT OF PACKING IN TRANSMITTER

Failure of the transmitter to deliver hydraulic pressure may indicate worn packing. To repack transmitter, proceed as follows:

(a) Move transmitter lever to "off" position.
(b) Remove double relief valve Fig. 11-7 which is threaded into transmitter housing.
(c) Move transmitter lever to "synchronous" position, allowing oil to drain out of reservoir.
(d) Move transmitter lever to "full on" position and remove stripper bolt and spring from lower end of piston assembly with 1/8" Allen wrench.

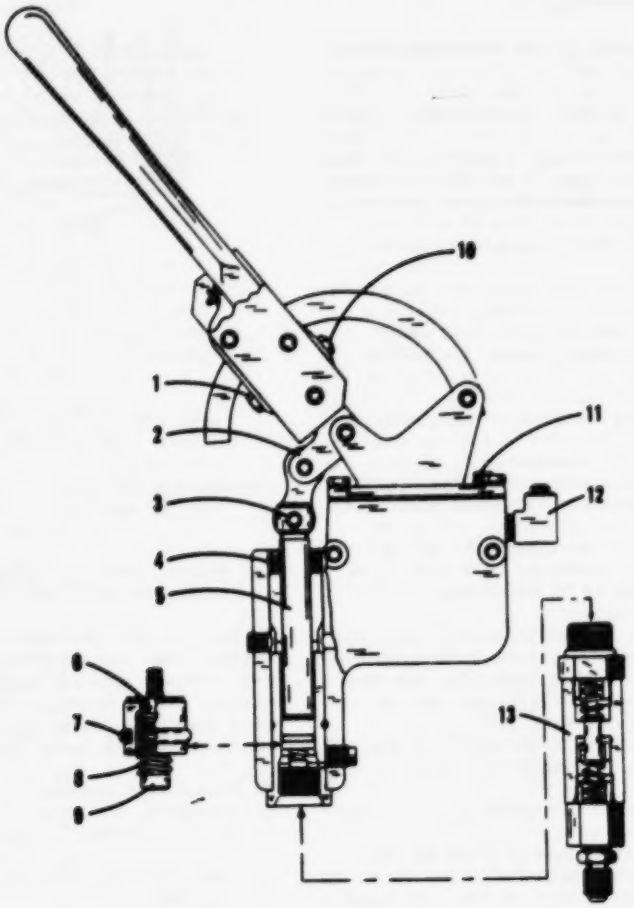


FIG. 11-7

TRANSMITTER AND DOUBLE RELIEF VALVE

(1) SETSCREW	(4) SEAL	(7) "O" RING	(10) SETSCREW
(2) LINK	(5) PISTON	(8) SPRING	(11) BREATHER CAP
(3) ROLLPIN	(6) WASHER SEAL	(9) STRIPPER BOLT	(12) FILLER
			(13) DOUBLE RELIEF VALVE

(e) Drive out one rollpin where linkage connects to top of piston. Move control lever to "off" position and remove piston from top of transmitter.

(f) Lower piston will remain in transmitter. To remove, insert blunt rod into top of transmitter and tap piston down until it can be removed from bottom of transmitter. Care should be taken to avoid scratching piston liner during this operation. The seal located above the lower cylinder piston will be removed with the piston.

Thoroughly clean reservoir and all parts and replace packing. Before installing "O" ring in lower cylinder groove, oil lightly and carefully slide "O" ring onto piston and into groove. Replace double lip seal in upper transmitter housing. Soak seal in oil prior to assembly. Install it with garter spring side down.

REASSEMBLY OF TRANSMITTER

Reassembly of transmitter can be accomplished as follows:

(a) Install upper piston from top side of transmitter.
(b) Connect control linkage to piston with rollpin. Install rollpin in position as shown. (Control linkage should be oiled periodically maintaining a light film of oil on it at all times). Move transmitter lever to "full on".
(c) Center new sealing washer on top of lower piston and install in transmitter.
(d) Install spring and stripper bolt and tighten bolt securely, using 1/8" Allen wrench.

The relief valve may be installed as follows:

(a) Fill transmitter reservoir.
(b) With hose connected to relief valve, fill upper end of relief valve, with hydraulic oil.
(c) With transmitter lever in "full on" position, connect transmitter to relief valve. Be sure "O" ring is placed between relief valve and transmitter.
(d) Bleed system as explained earlier in this Section. If hose is disconnected from relief valve, or, when installing new hose, fill hose with oil. Fill lower end of double relief valve with fluid prior to connecting to hose. Avoid spilling any more fluid than necessary.

REPLACEMENT OF "O" RING IN RECEIVER

Loss of pressure and hydraulic fluid at the receiver may indicate a worn "O" ring, loose fitting or loose pipe plug. If loss of fluid is observed around the piston, proceed as follows:

(a) Move transmitter lever to "off" position.
(b) Disconnect hose from receiver. Plug hose to prevent loss of fluid.
(c) Remove receiver from Hammer.
(d) Loosen setscrew on receiver housing and remove piston from housing. See Fig. 11-8.
(e) Replace "O" ring and reassemble piston in cylinder.
(f) Replace setscrew, tightening down against slot in piston finger tight. Back off setscrew one turn and lock securely with jam nut. This setscrew serves as a piston-stop preventing piston from being accidentally discharged from cylinder, especially when fuel pump is removed. Overtightening setscrew will restrict or jam piston.

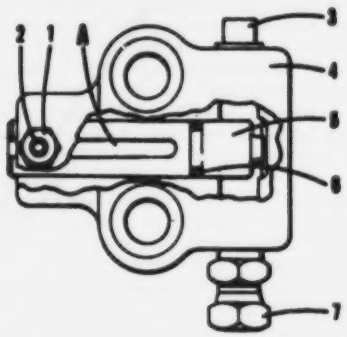


FIG. 11-8

HYDRAULIC RECEIVER

(A) RETAINING SLOT

(1) NUT
(2) SETSCREW
(3) PIPE PLUG
(4) HOUSING
(5) PISTON
(6) "O" RING
(7) ADAPTER UNION

(g) Install receiver on Hammer. Tighten capscrews to specified torque.

Failure of receiver piston to retract into cylinder may indicate scored cylinder walls, over torqued mounting capscrews jammed receiver piston, air in hydraulic control system jammed fuel pump rack, loose return spring mounting or loose or worn lever linkage.

If transmitter handle has been completely disassembled, and after reassembling, the following adjustment procedure must be made.

(a) Back off setscrew, Fig. 11-7, 1/4" from linkage.
(b) Turn setscrew, Fig. 11-7, in until hand lever does not lock when moved to the "on" position. Then back off on setscrew until lever does just lock when moved to the "on" position.
(c) With hand lever in the "on" position, turn setscrew Fig. 11-7, until it contacts linkage. Then back off on setscrew 1-1/2 to 2 turns.
(d) Set both jam nuts on setscrews.

CLEANLINESS

The utmost care should be used when handling the parts of the hydraulic control system. If dirt or any abrasive material is allowed to enter the system it will score cylinder walls and pistons, damage packing and prevent the system from operating properly.

HYDRAULIC FLUID

Refer to lubrication chart for recommended hydraulic fluid for the control system. Hydraulic brake fluid must never be used, as use of this will result in rapid deterioration of the "O" ring packings. Approximately three pints of fluid or more is required to fill the system, depending on length of hose.

FUEL INJECTION SYSTEM

Fuel oil is contained in a tank which is mounted on the top half of the cylinder. It is filtered by an element which is located inside the tank. The fuel is supplied to the fuel injection pump by gravity flow through a hose from the fuel tank.

A high pressure fuel line delivers the fuel from the fuel pump to the injector. When the fuel pressure reaches the "pop-off" setting of the injector, fuel is introduced in atomized form into the combustion chamber in the ram and anvil.

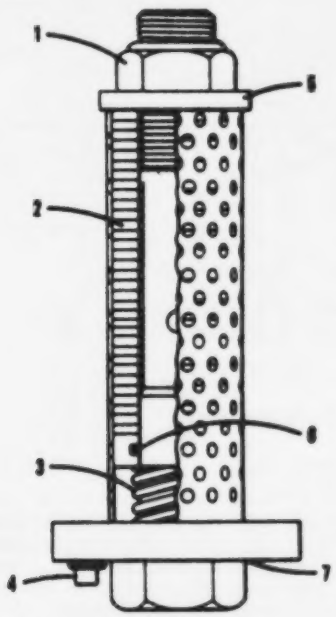


FIG. 11-9

FUEL FILTER ASSEMBLY

(1) LOCKNUT
(2) FILTER ELEMENT
(3) SPRING
(4) PIPE PLUG
(5) END PLATE, TOP
(6) "O" RING
(7) FILTER HEAD

FUEL FILTER

THE FILTER ELEMENT WHICH IS MOUNTED IN THE BOTTOM OF THE FUEL TANK SHOULD BE REPLACED AFTER THE FIRST WEEK OF OPERATION AND ONCE A MONTH THEREAFTER. (OFTENER UNDER DUSTY CONDITIONS). The filter has a paper disc type element, Fig. 11-9 and can be removed by removing the four capscrews which hold it into the bottom of the tank.

(a) Drain tank by removing plug from bottom of filter assembly.
(b) Remove capscrews holding filter in place and remove filter from tank.
(c) Remove large nut from top of filter.
(d) Remove and replace element.
(e) Replace large nut.
(f) Flush tank with Diesel fuel.
(g) Replace gasket between filter and tank. Also check condition of "O" Ring and replace if necessary.
(h) Replace filter in tank.
(i) Refill tank with a Diesel fuel conforming to the specifications listed on the Lubrication Chart.

FUEL INJECTION PUMP

The fuel injection pump Fig. 11-10, is supplied with fuel oil, gravity fed through a hose from the fuel tank to the entrance located on the side of the pump.

The pump is operated by a bell crank lever with a needle-bearing roller which contacts the machined cam surface of the ram. As the upper cam surface contacts the roller, the bell crank forces the pump piston downward placing fuel under pressure in the fuel line to the injector. The fuel pump is an American Bosch Type, manufactured to Link-Belt Speeder specifications.

The fuel pump bell crank can be disassembled by proceeding as follows:
(a) Wash fuel pump fittings with Diesel fuel to insure dirt free operation after reassembly.
(b) Advance throttle to "on" position, lock rack return spring rod in compressed position (see "B" Fig. 11-10) with nail or piece of wire and return throttle to "off" position. Remove and plug fuel and lube oil inlet and outlet lines. Remove fuel and lube pumps from pump drive housing.
(c) Remove housing by removing four capscrews.
(d) Pull pin, which holds bell crank rod in place, from housing.
(e) Tap bell crank rod out of housing using malleable rod. Do not use hard punch rod.

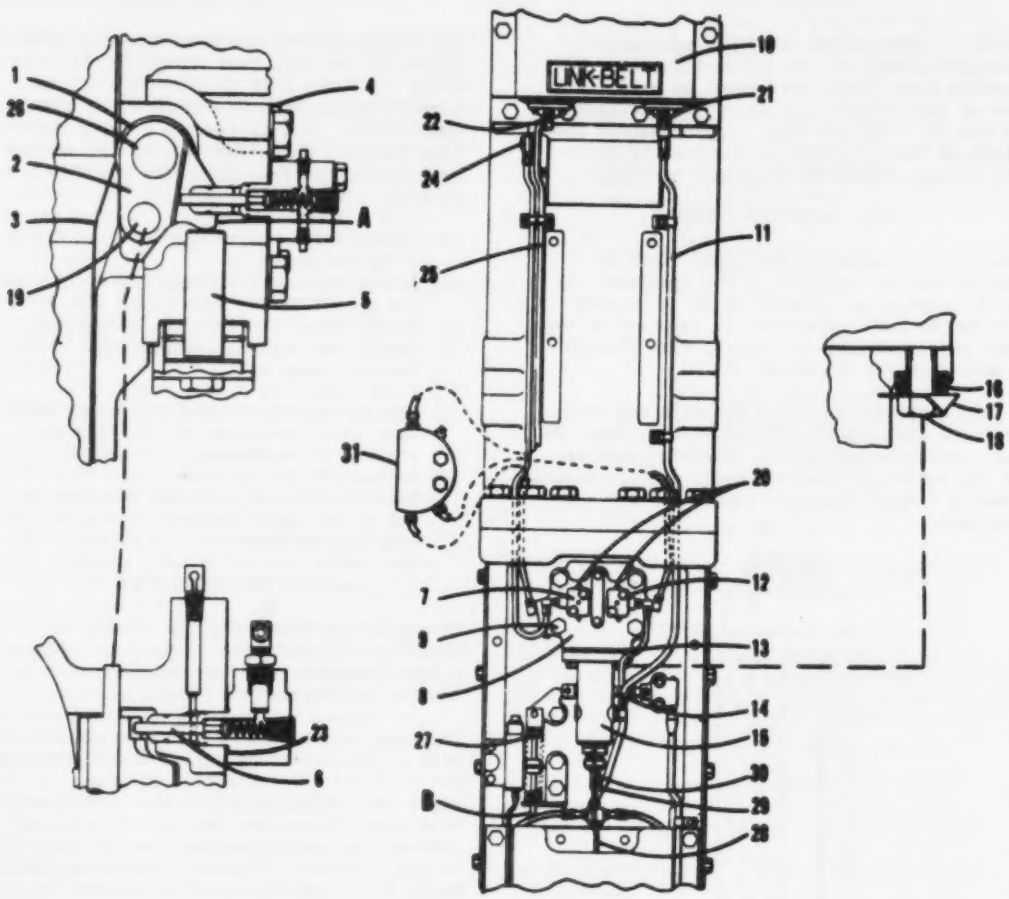


FIG. 11-10

FUEL & LUBRICATING OIL PUMPS & DRIVE ASSEMBLIES

(A) HOLE FOR PRIMING LEVER
(B) LOCATION OF SPRING ROD RETAINING HOLE WHEN SPRING IN COMPRESSED POSITION

(1) ROLLER
(2) BELL CRANK LEVER
(3) CAM SURFACE ON RAM
(4) COVER PLATE
(5) TAPPET
(6) LUBE PUMP PLUNGER
(7) LUBE PUMP, LEFT HAND
(8) PUMP DRIVE HOUSING
(9) CAPSCREWS
(10) FUEL AND LUBE OIL TANK
(11) FUEL LINE
(12) LUBE PUMP, RIGHT HAND
(13) FUEL PUMP SHIMS
(14) FUEL PUMP RACK
(15) FUEL PUMP
(16) SPRING WASHERS
(17) LOCKPLATE
(18) CAPSCREW
(19) BELL CRANK LEVER
(20) LUBE PUMP BLEED SCREWS
(21) FUEL TANK OUTLET AND FILLER
(22) LUBE TANK OUTLET AND FILLER
(23) LUBE PUMP SHIMS
(24) LUBE CHECK VALVE
(25) LUBE OIL INLET LINE
(26) ROLLER MOUNTING PIN
(27) RACK RETURN SPRING
(28) HIGH PRESSURE LINE
(29) BRONZE NUT
(30) STEEL NUT
(31) LUBE OIL HEADER

The fuel pump rack is located in the center of the pump body. It is spring loaded for fuel shut off. The rack limiting stop consists of the two spring guides at each end of spring. The sleeve portions of these spring guides contact the pump body, limiting the rack opening to no more than 32 mm. as marked on the rack.

FUEL PUMP TIMING

The fuel pump timing window is located left of-center and just below the pump mounting flange. Using a screwdriver, remove the screws, cover, and gasket to expose the timing marks as shown in Fig. 11-11. The following procedure may be used to check or retime the pump.

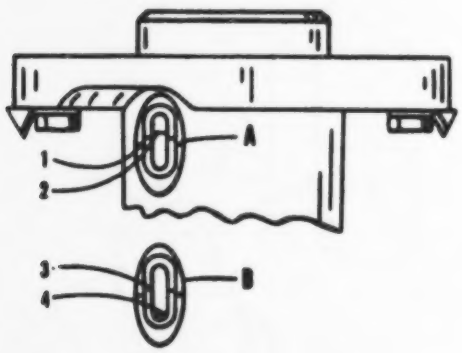


FIG. 11-11

FUEL PUMP TIMING

DETAIL (A) - TIMING MARKS WITH RAM UP
DETAIL (B) - TIMING MARKS WITH RAM DOWN

(1) INDEX MARKS ON WINDOW
(2) TIMING MARK
(3) INDEX MARKS
(4) TIMING MARK

(a) Lift the entire Hammer clear of piling, anvil in the down position, and tip the Hammer forward slightly, toward the fuel pump. This assures that the weight of the ram is against the cam roller , Fig. 11-11, forcing the tappet to the lowest position it goes during operation.
(b) The relative position of the timing marks should appear somewhat as pictured in Detail (B) of Fig. 11-11. Timing mark should be at least 1/32" above the bottom of the window to prevent possible bottoming of the internal parts of the pump.

THE TIMING MARK FIG. 11-11, SHOULD NEVER BE ALLOWED TO LEAVE THE WINDOW EITHER DURING HAMMER OPERATION OR WHILE CHECKING TIMING.

Add shims to increase or remove shims to decrease this dimension and obtain as close to 1/32" plus as possible.

When installing a new pump, leave capscrews Fig. 11-10, loose so that the timing mark never leaves the window; tighten to position timing mark and determine shims required to obtain as close to 1/32" as possible. Insert shims and tighten per recommended torque. Check this dimension again.

(c) Set the Hammer on a piling, or driving head, latch in and raise the ram about 17". At this time the timing marks will appear as in Detail (A), Fig. 11-11. Timing mark (2) should be a minimum of 1/32" above index mark (1). Loosen capscrews Fig. 11-10, and determine number of shims needed to obtain this dimension and in no case should timing mark (2), Fig. 11-11, be more than 3/32" above index mark (1).
(d) Insert shims and replace capscrews and torque to recommendations under "FUEL PUMP REPLACEMENT".

Satisfactory operation of the fuel pump depends upon proper care and maintenance of its precision parts. Above all, the working parts of the pump must be kept dirt free. Weekly inspect the control rack Fig. 11-10, for possible dirt accumulation and clean with a brush and fuel oil to prevent excessive wear of rack and mating gears. When assembling pump on the housing, carefully wipe all dirt from the mounting surfaces to insure square seating of the pump. Use a lint free wiping cloth for this purpose. Never use waste.

Periodically check the control rack actuating mechanism (links, pin, and rack return spring assembly for wear, looseness, binding or misalignment. Replace all worn or questionable parts. Replace parts if worn or tend to bind.

FUEL PUMP REMOVAL

The fuel pump can be removed from the Hammer by proceeding as follows:

(a) Wash fuel lines connected to bottom of pump with Diesel fuel in order that dirt and grease may be removed.
(b) Disconnect high-pressure tubing from bottom of pump.

WHENEVER IT IS NECESSARY TO REMOVE HIGH-PRESSURE LINE, THE BRONZE NUT FIG. 11-10, SHOULD BE LOOSENED FIRST AND THEN THE STEEL NUT CAN BE REMOVED FROM THE MALE FITTING.

(c) Straighten lockplate Fig. 11-10, and remove capscrews which hold pump in place.
(d) Advance throttle to full on, pin return spring rod in compressed position (See "B" Fig. 11-10) with piece of wire or nail and return throttle to "off" position.
(e) As pump is lowered, the fuel pump tappet will slide out of housing. (Check tappet for wear).
(f) Count timing shims located between pump and housing.

FUEL PUMP REPLACEMENT

Replace pump using following procedure:

(a) Raise ram 17" to reduce cam surface pressure from pump plunger.
(b) Install capscrews with six spring washers beneath each capscrew. Spring washers have to be installed as shown in Fig. 11-10, with first two convex side out, the next two concave side out, and the last two convex side out.
(c) Replace correct number of timing shims on pump flange and place fuel pump into position. Always recheck timing when installing replacement pump, as pump may have new dimensions.
(d) Tighten capscrews alternately until pump contacts housing. A definite resistance should be felt after shims have been flattened.
(e) Turn capscrews an additional half turn, which will somewhat compress spring washers, and bend an ear of lockplate over a flat of capscrew. The torque obtained by the above sequence will approach those listed in the "TORQUE CHART".
(f) Advance throttle to full "on" position and remove nail or wire holding return spring.

The fuel line is of high pressure steel tubing connected to the fuel pump by means of a line fitting assembly. To remove the line, the bronze nut should be loosened first when the line is being removed and tightened last (slightly more than finger tight) when replacing the high pressure line. It contains a rubber vibration dampener which could be damaged if the steel union nut were removed first. When loosening the union nut, the line fitting should be held with a wrench.

FUEL INJECTOR

The fuel injector nozzle and holder is of the American Bosch Type. The fuel injector assembly has been factory set to open at 2600 P.S.I.

It is advisable to inspect the injector nozzle assembly periodically and replace as necessary.

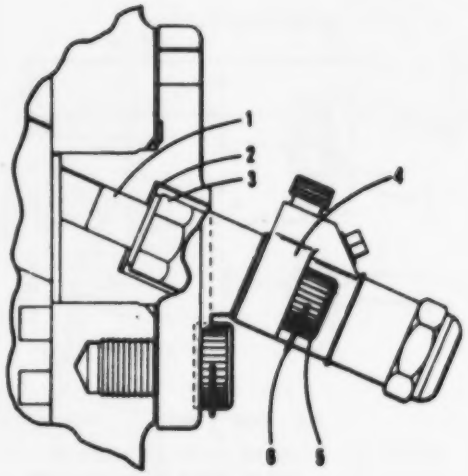


FIG. 11-12

INJECTOR ASSEMBLY

(1) NOZZLE
(2) SPRING WASHER
(3) RETAINING NUT
(4) NOZZLE HOLDER
(5) CAPSCREWS
(6) SAFETY WIRE

TO VISUALLY CHECK AN INJECTOR

(a) Before loosening any lines, apply kerosene or Diesel fuel freely to all connections in order that dirt and grease may be removed.
(b) Loosen the bronze nut containing the rubber seal ring.
(c) Loosen the steel nut which connects the nozzle holder to the high pressure fuel line.

(d) Remove the socket head capscrews Fig. 11-12, and pull injector assembly from the Hammer. BE CAREFUL NOT TO STRIKE THE END OF THE NOZZLE AGAINST ANY HARD SURFACE.
(e) Assemble the injector on the high pressure fuel line facing outward.
(f) Remove cover plate Fig. 11-10, from housing which contains the pump operating bell crank.
(g) Raise the ram 17" and lock hoist brake.
(h) Open fuel rack.
(i) Insert hand priming lever, supplied with tools, in the hole provided in the bell crank.

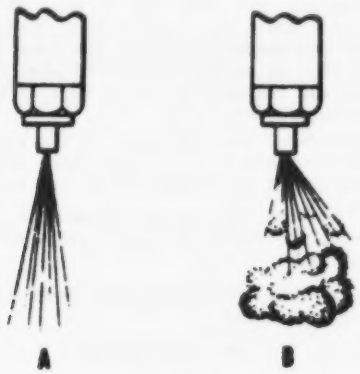


FIG. 11-13

NOZZLE SPRAY PATTERNS

(A) GOOD NOZZLE SPRAY PATTERN
(B) POOR NOZZLE SPRAY PATTERN

(j) Using a sharp pull on the lever, hand operate the fuel injection system. Nozzle should emit a fine narrow cone shaped fuel spray. If any "flags" or "streamers" of fuel are observed, have nozzle replaced. See Fig. 11-13. It is wise to have new nozzle assemblies on hand so no time will be lost while the defective assemblies are being replaced or cleaned.

WARNING

THE PENETRATING POWER OF OIL UNDER PRESSURE IS SUFFICIENT TO PUNCTURE THE SKIN AND MAY CAUSE BLOOD POISONING. THEREFORE, HANDS MUST BE KEPT AWAY FROM THE SPRAYING NOZZLE.

Fuel injector problems are many times the result of improper injector maintenance and improper mounting of holder on the Hammer. They are usually accompanied by one or more of the following symptoms: injector leakage; fuel line breakage; nozzle holder capscrew failure; fuel pump capscrew breakage; loss of compression and lowered Hammer energy output. Operating with a "coked" up injector assembly or dirty fuel can also cause some of the problems mentioned above.

To mount injector on Hammer, the following procedure should be used:

(a) Clean nozzle recess in the nozzle adapter before installing injector and washer to insure square seating.
(b) Using a new spring washer, Fig. 11-12 install injector in Hammer. The washer should be placed on the nozzle convex side (curved side) toward the nozzle holder.
(c) Install capscrews and tighten to the torque value recommended on the Torque Chart.
(d) Wire capscrew heads using .041" gauge safety wire. Use of a soft wire is not recommended as such wire will stretch and allow capscrews to loosen. The wire must wrap off capscrews in a clockwise direction.

Under no circumstances should the Hammer be operated with a nozzle holder having blow-b since this will cause localized heat, which will distort the nozzle, damaging it beyond repair.

LUBRICATION SYSTEM

The ram and cylinder wall are lubricated by two single plunger lube oil pumps. Lube oil is supplied to the pumps by gravity flow fro the lube oil tank passing through a filter inside the tank. The pump to the right, as you face the Hammer lubes the lower cylinder and pump on the left lubes upper cylinder.

The pumps are operated by the same bell crank assembly that operates the fuel pump. As the ram falls the bell crank moves the lube oil pump plunger Fig. 11-14, forcing a small amount of lube oil past a check valve in the pump and delivers the oil to the cylinder

Routine inspection should be made of the ram to insure proper lubrication. The ram can be observed through the intake-exhaust port and bounce chamber vent port in upper cylinder and should be inspected as each pile is driven. The ram should always be covered with a film of oil. Insufficient lubrication will result in damaged rings and scored cylinder walls.

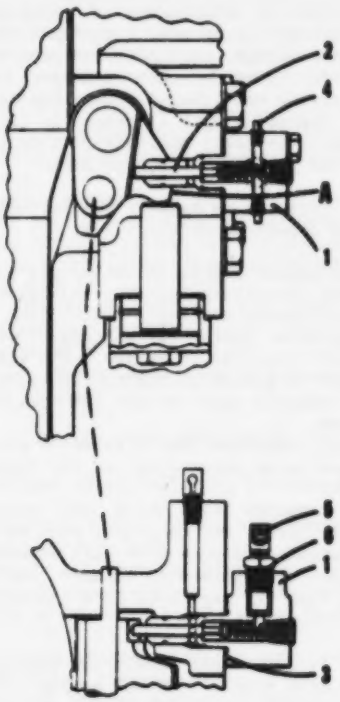


FIG. 11-14

LUBRICATING OIL PUMP

(A) RECESS FOR PRIMING LEVER

(1) OIL PUMP (4) PIPE PLUG
(2) PLUNGER (5) OUTLET
(3) SHIMS (6) CHECK VALVE

If a dry ram is observed, shut down the Hammer immediately and inspect the entire lubrication system. Check for the following:

(I) Empty lube oil tank. To avoid running out of lube oil, fill the lube oil tank every four hours, or whenever filling the fuel tank.
(II) Clogged filter in tank due to dirt and foreign material in the oil. This filter is cadmium plated and can be washed with diesel fuel.
(III) Lube supply line broken, loosened or clogged.
(IV) Incorrect weight lube oil being used. Refer to Lubrication Chart.
(V) Water or ice in lube tank.
(VI) Faulty lube oil pump.

To check lube oil pump operation and for lube pump bleeding and output adjustment the following procedure should be followed:

> NOTE: Each lube pump must be bled and adjusted individually, starting with the pump to your right as you face the Hammer. Bleed and adjust lube pumps with Hammer in vertical position.

LUBE PUMP BLEEDING

(a) Raise the ram 17" and hold.
(b) Loosen and remove pipe plug (4), Fig. 11-14 on top of lube pump.
(c) With the fuel pump rack in the "off" position, insert the hand priming lever at point "A" and manually operate the lube pump.
(d) As soon as approximately 1/8 pint of oil has run through and it is free of air, retighten pipe plug.
(e) Disconnect the lube line at the pump outlet and continue manually operating the lube pump until oil comes out of the outlet.
(f) If no lube pump output adjustment is required, reconnect and tighten lube line pump.
(g) Bleed lube oil header Fig. 11-10 after both pumps are bled.

LUBE PUMP OUTPUT

(a) After bleeding the system, with the fuel pump rack in "off" position and the two lube lines disconnected at the pump outlet, drop the ram from a height of 8" inches or more, several times.
(b) Adjust pump flow to one drop (each pump) per stroke. To increase pump delivery remove shims Fig. 11-14, from beneath the lube pumps. This will increase the length of lube oil pump plunger stroke. To decrease pump delivery and lube oil discharge, add shims. Do not remove lube pumps when shimming. Only remove capscrews and add or subtract shims by sliding in or out as required.
(c) Reconnect and tighten lube lines to cylinder fittings.

Excessive lubrication can be caused by a defective check valve in the lube oil pump. To check for this malfunction, fill lube oil tank at least half full. Remove discharge line from pump. If oil siphons from pump, the check valve is not functioning properly and should be replaced. This is a cartridge type insert check valve.

A check valve is provided at the lube oil

inlet of the upper cylinder to keep the line full when the Hammer is being handled and laid down.

Excessive lube oil may cause flaming in the combustion chamber after normal combustion of fuel has taken place, thus robbing oxygen in the cylinder for the succeeding power stroke.

The lube oil filter should be thoroughly washed with clean Diesel fuel at least every three months, or oftener, depending on job conditions. The following procedure may be used for removing and cleaning the filter:

(a) Drain oil from tank by removing plug from lower end of filter.
(b) Remove four capscrews Fig. 11-15, holding filter head in place and lower filter.
(c) Remove large nut from top of filter.
(d) Remove screen type filter and wash in solvent or diesel fuel.
(e) Check condition of "O" ring in bottom end plate. Replace if necessary.
(f) Use new gasket and reinstall filter by reversing removal procedure.

At low temperatures, oil may be too heavy to properly flow to the pump. If so, drain and flush tank and replace with lighter oil. The lube oil tank should be cleaned and flushed seasonally to insure cleanliness. Tank should also be flushed before changing to different oil weight. Check the Lubrication Chart for oil recommendations.

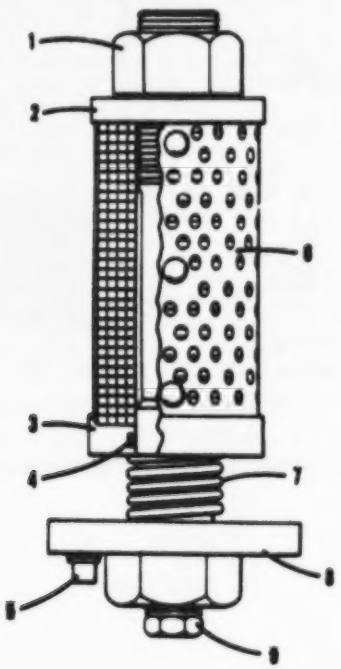


FIG. 11-15

LUBRICATING OIL FILTER

(1) LOCKNUT
(2) TOP END PLATE
(3) BOTTOM END PLATE
(4) "O" RING
(5) DRAIN PLUG
(6) FILTER ELEMENT
(7) SPRING
(8) FILTER HEAD
(9) PIPE BUSHING

STARTING FLUID INJECTOR

The starting fluid injector should be checked periodically.

A filter screen is located at the tube connection, Fig. 11-16, at this time. Remove the connector and clean the screen once a month. Inspect mounting bolts and connections weekly and tighten if necessary.

If the starting fluid injector system is not required for extended periods of operation, it may be removed from the Hammer. After removal, be sure to install special capscrew and gasket in tapped hole in lower cylinder. These items are included with new Hammer spare parts.

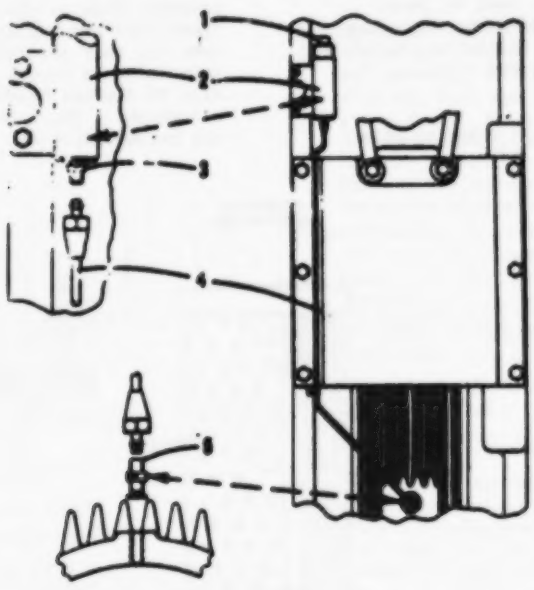


FIG. 11-16

STARTING FLUID INJECTOR

(1) CAP
(2) TANK
(3) SCREEN
(4) TUBE
(5) CHECK VALVE

SPECIFICATIONS - DIMENSIONS - WEIGHTS

SHIPPING DIMENSIONS	
DEPTH	40 INCHES
WIDTH	41 INCHES
HEIGHT	229 INCHES
WEIGHT	14,500 POUNDS
CUBAGE	217 CUBIC FEET
DIMENSIONS AND WEIGHTS	
SHIPPING CUBE	69 CUBIC FEET
HEIGHT	174-1/4 INCHES
WIDTH	20 INCHES
DEPTH	34-1/8 INCHES
WEIGHT	9,230 POUNDS
HAMMER OVER-ALL LENGTH* (HAMMER ONLY)	14'-6-1/4"
OPERATING LENGTH OF HAMMER WITH RECOIL DAMPENER ADAPTER ASSEMBLY AND DRIVING HEAD - AVERAGE LENGTH FROM TOP OF HAMMER TO DRIVING SURFACE OF DRIVING HEAD	15'-8"
MINIMUM OPERATING LENGTH OF LEAD FOR HAMMER AND RECOIL DAMPENER ADAPTER ASSEMBLY IF 3/4" OR 7/8" CRANE LINE ATTACHED DIRECTLY TO STARTING MECHANISM- SEE CABLE SPEC. NOTE	16'-3"
APPROXIMATE OPERATING LENGTH OF LEAD FOR HAMMER AND RECOIL DAMPENER ADAPTER ASSEMBLY IF CRANE HOIST LINE ATTACHED TO CABLE EYE ON STARTING MECHANISM	21'
EQUIVALENT "WH" (GAUGE) ENERGY RATING, MAX. FT. LBS.	18,200
MAXIMUM EQUIVALENT STROKE, BASED ON FREE FALL, PLUS "BOUNCE CHAMBER" ENERGY (DISREGARDS DRIVING EFFECT OF FUEL COMBUSTION), INCHES	54.6"
SPEED BLOWS PER MINUTE	86 - 90
FUEL OIL TANK CAPACITY, GAL. (ADEQUATE FOR NORMAL DAY)	13
LUBE OIL TANK CAPACITY, GAL. (ADEQUATE FOR NORMAL DAY)	1.8
RECOMMENDED FACE WIDTH OF GUIDE RAILS, INCHES	6" to 9"
MINIMUM SPACE BETWEEN GUIDE RAILS, INCHES	20-1/2"
HYDRAULIC TRANSMITTER AND HOSE CAPACITY, (APPROX.) PINTS	3

*EQUIPPED WITH STANDARD FULL LENGTH GUIDE ANGLES, BUT NO DRIVING HEAD.

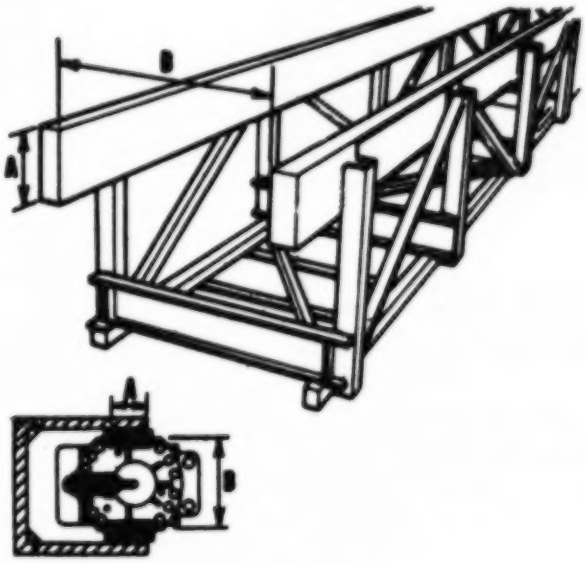
NOTE: CABLE SPECIFICATIONS - 7/8 or 3/4" DIAMETER, 6 X 25 FILLER WIRE, IMPROVED PLOW STEEL, PREFORMED, RIGHT LAY, REGULAR LAY, INDEPENDENT WIRE ROPE CENTER.

Not Applicable

HANGER DIMENSIONS (for assistance in building leads)

(A) Face Width of Guide Rail, 6 to 9 inches.

(B) Space Between Guide Rails, 20-1/2 inches.



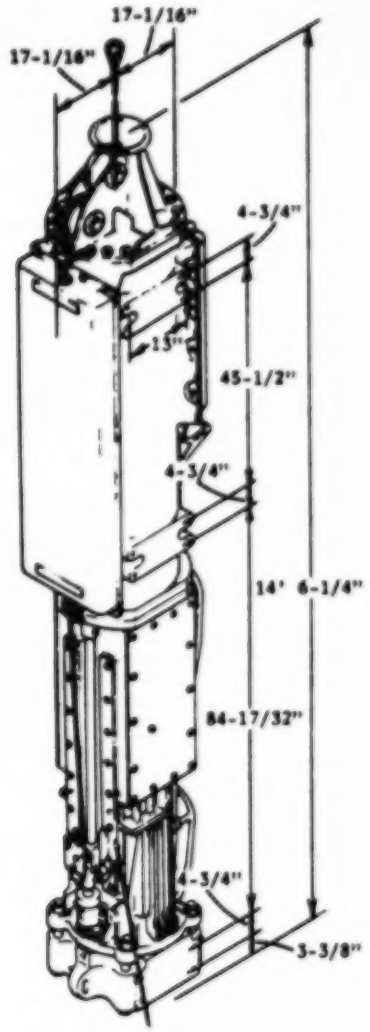


FIGURE 12-2

SECTION 13 TORQUE CHART

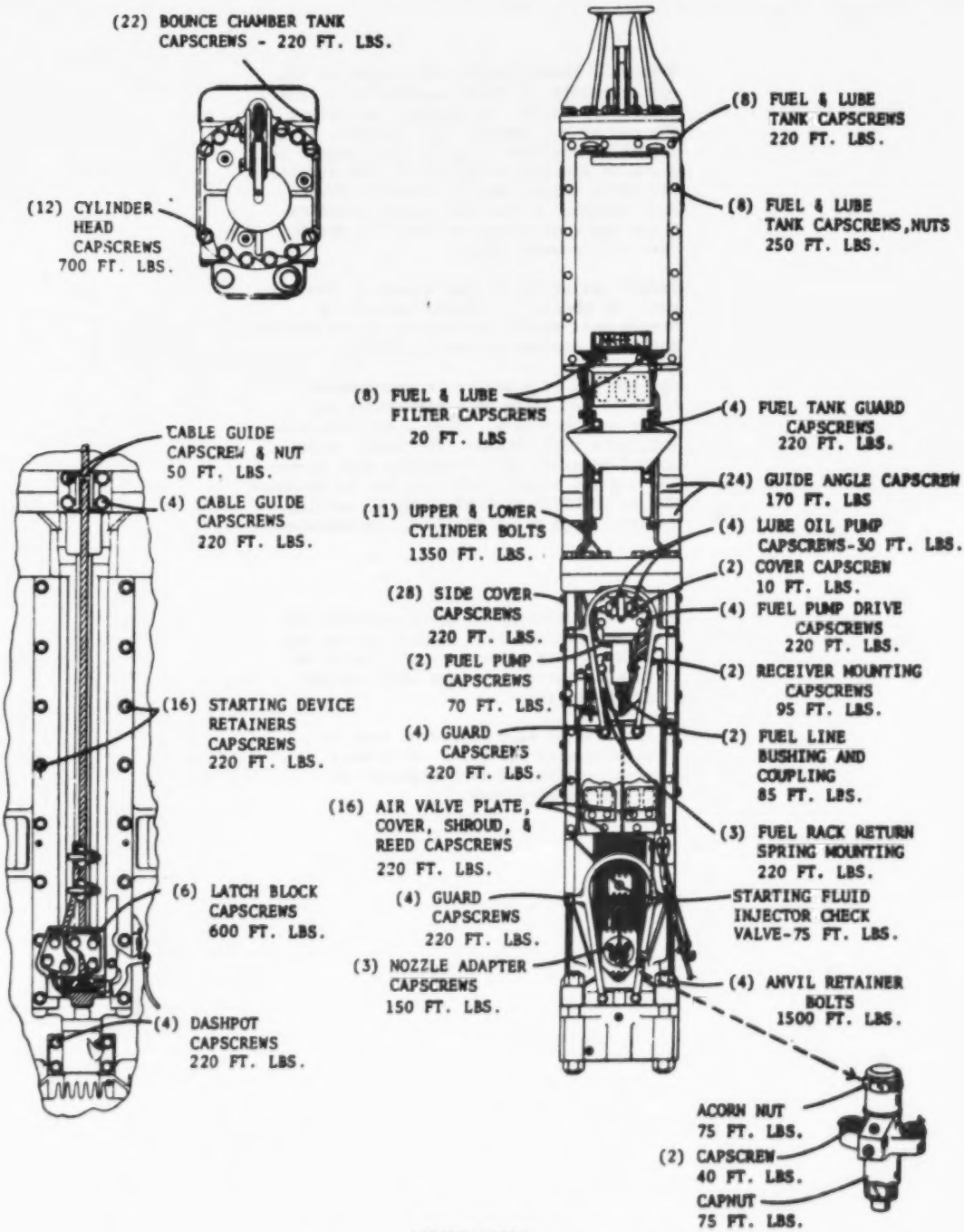
Torque is determined by the length of the wrench handle (in feet) multiplied by the weight (or force - in pounds) applied at the end of the handle. For example, if the wrench is one foot long and five pounds of force is applied at the end of the handle, the total torque applied would be five foot pounds; a six inch wrench would require ten foot pounds of force to obtain five foot pounds torque.

Proper use of the torque wrench is important. To obtain the listed torques, a steady pull should be exerted to the handle until the desired torque is reached.

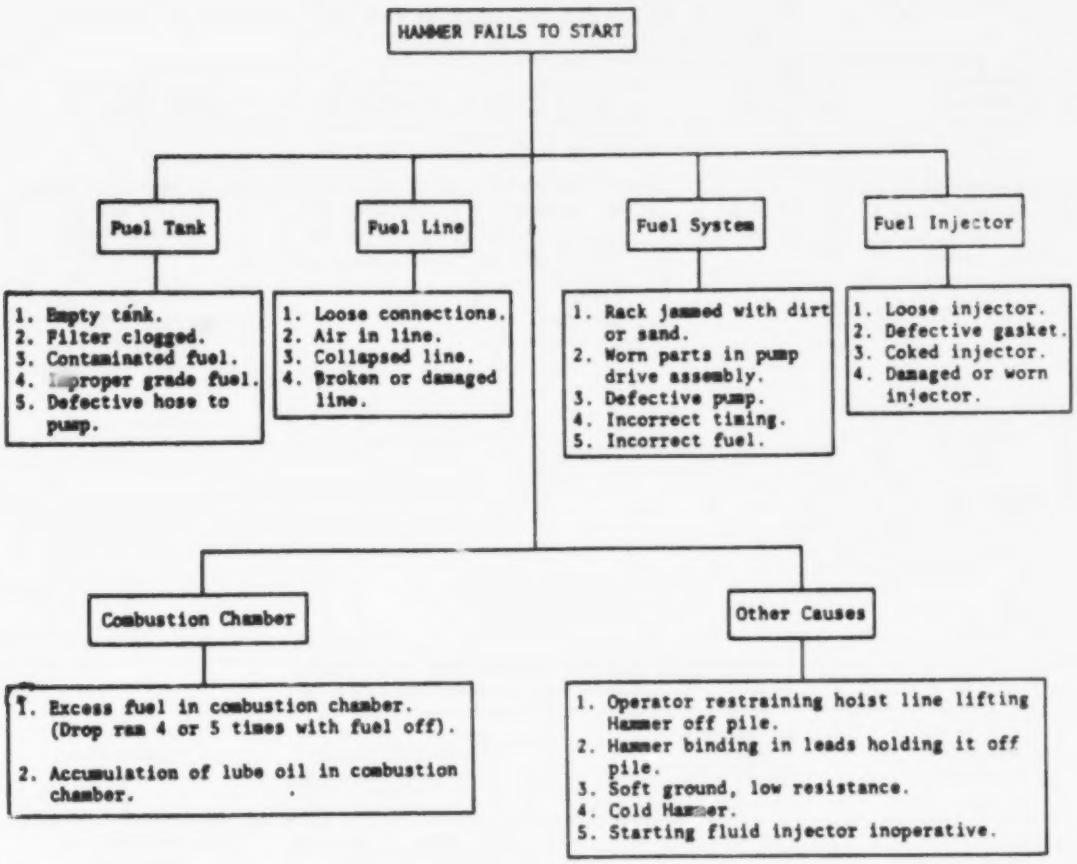
Application of a sealer is recommended whenever replacing or retightening any bolts and, hardware. Before applying sealant, make sure threads are clean. Grease or oil on studs will interfere with proper bonding and a good seal will not be obtained. Use of LOCKTITE SEALANT TYPE "A" meeting specification MIL-S-22473A is recommended.

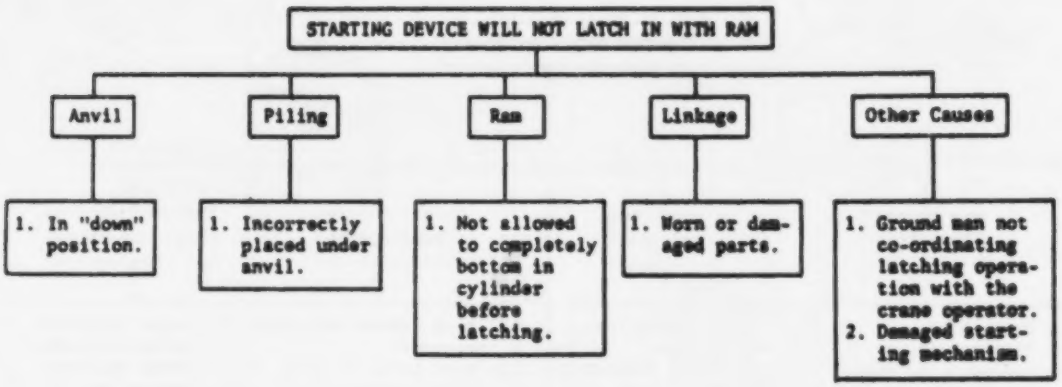
If castellations on anvil retainer nut do not line up with drilled cotter pin hole on bolt after torque value is obtained, increase torque until cotter can be inserted.

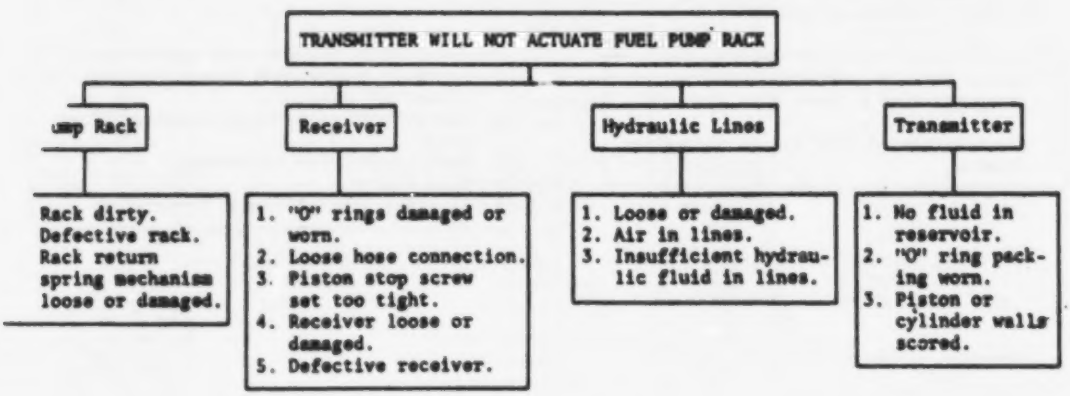
All drilled head capscrews must be secured with tie wire. Wire must wrap tightly off each capscrew in clockwise direction.

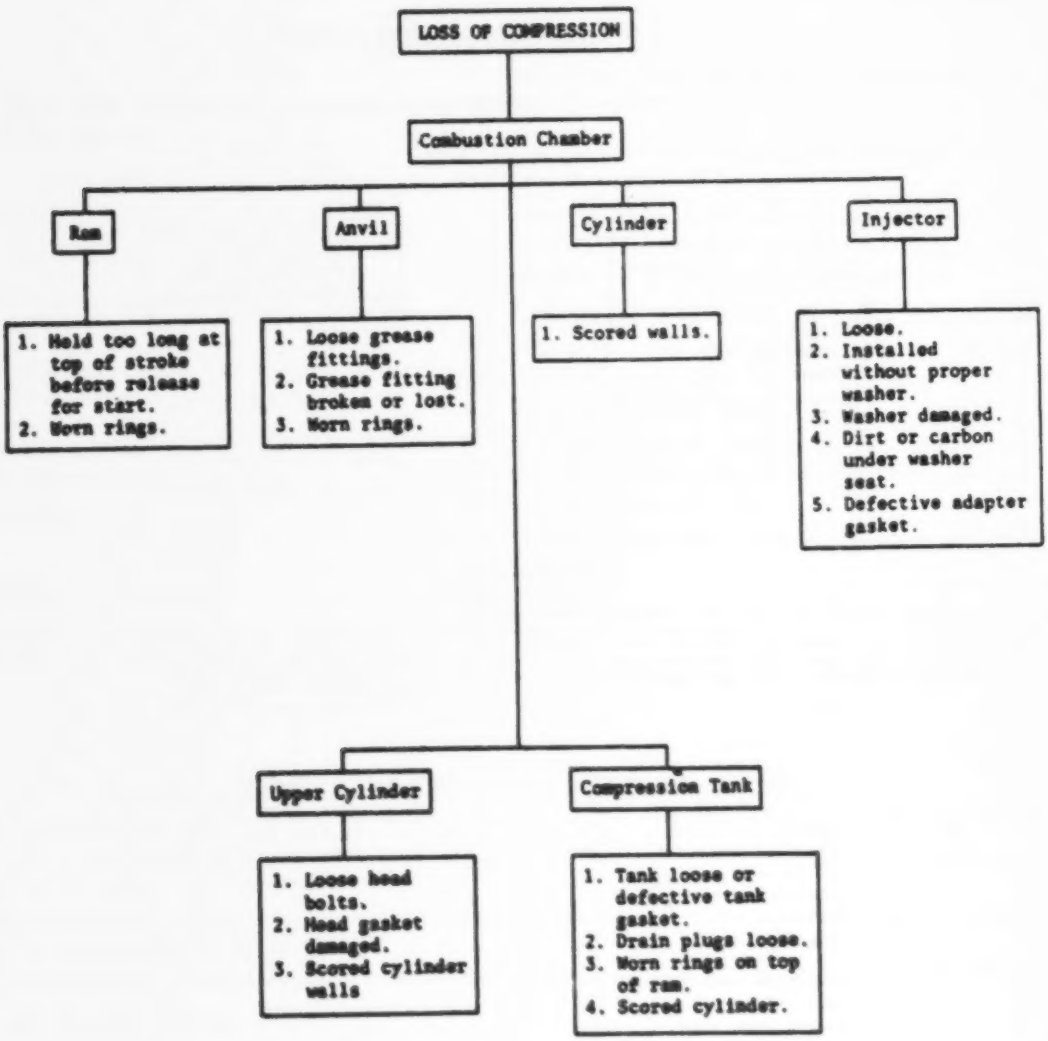

(22) BOUNCE CHAMBER TANK CAPSCREWS - 220 FT. LBS.
(12) CYLINDER HEAD CAPSCREWS 700 FT. LBS.
(8) FUEL & LUBE TANK CAPSCREWS 220 FT. LBS.
(8) FUEL & LUBE TANK CAPSCREWS, NUTS 250 FT. LBS.
(8) FUEL & LUBE FILTER CAPSCREWS 20 FT. LBS
(4) FUEL TANK GUARD CAPSCREWS 220 FT. LBS.
CABLE GUIDE CAPSCREW & NUT 50 FT. LBS.
(4) CABLE GUIDE CAPSCREWS 220 FT. LBS.
(24) GUIDE ANGLE CAPSCREW 170 FT. LBS
(11) UPPER & LOWER CYLINDER BOLTS 1350 FT. LBS.
(4) LUBE OIL PUMP CAPSCREWS-30 FT. LBS.
(2) COVER CAPSCREW 10 FT. LBS.
(28) SIDE COVER CAPSCREWS 220 FT. LBS.
(4) FUEL PUMP DRIVE CAPSCREWS 220 FT. LBS.
(2) FUEL PUMP CAPSCREWS 70 FT. LBS.
(2) RECEIVER MOUNTING CAPSCREWS 95 FT. LBS.
(16) STARTING DEVICE RETAINERS CAPSCREWS 220 FT. LBS.
(4) GUARD CAPSCREWS 220 FT. LBS.
(2) FUEL LINE BUSHING AND COUPLING 85 FT. LBS.
(16) AIR VALVE PLATE, COVER, SHROUD, & REED CAPSCREWS 220 FT. LBS.
(3) FUEL RACK RETURN SPRING MOUNTING 220 FT. LBS.
(6) LATCH BLOCK CAPSCREWS 600 FT. LBS.
(4) GUARD CAPSCREWS 220 FT. LBS.
STARTING FLUID INJECTOR CHECK VALVE-75 FT. LBS.
(3) NOZZLE ADAPTER CAPSCREWS 150 FT. LBS.
(4) ANVIL RETAINER BOLTS 1500 FT. LBS.
(4) DASHPOT CAPSCREWS 220 FT. LBS.
ACORN NUT 75 FT. LBS.
(2) CAPSCREW 40 FT. LBS.
CAPNUT 75 FT. LBS.

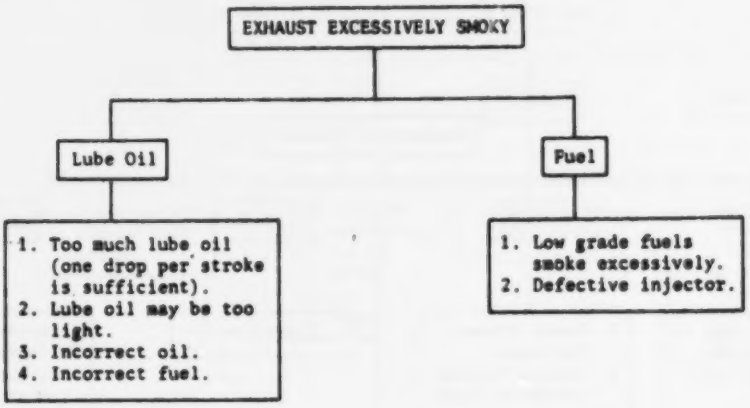
TORQUE CHART

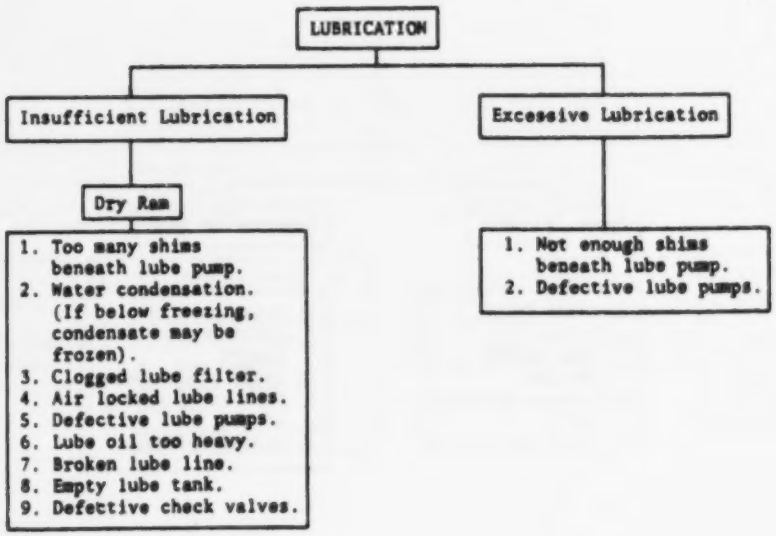

HAMMER FAILS TO START
Fuel Tank
1. Empty tank.
2. Filter clogged.
3. Contaminated fuel.
4. Improper grade fuel.
5. Defective hose to pump.
Fuel Line
1. Loose connections.
2. Air in line.
3. Collapsed line.
4. Broken or damaged line.
Fuel System
1. Rack jammed with dirt or sand.
2. Worn parts in pump drive assembly.
3. Defective pump.
4. Incorrect timing.
5. Incorrect fuel.
Fuel Injector
1. Loose injector.
2. Defective gasket.
3. Coked injector.
4. Damaged or worn injector.
Combustion Chamber
1. Excess fuel in combustion chamber. (Drop ram 4 or 5 times with fuel off).
2. Accumulation of lube oil in combustion chamber.
Other Causes
1. Operator restraining hoist line lifting Hammer off pile.
2. Hammer binding in leads holding it off pile.
3. Soft ground, low resistance.
4. Cold Hammer.
5. Starting fluid injector inoperative.


STARTING DEVICE WILL NOT LATCH IN WITH RAM
Anvil
1. In "down" position.
Piling
1. Incorrectly placed under anvil.
Ram
1. Not allowed to completely bottom in cylinder before latching.
Linkage
1. Worn or damaged parts.
Other Causes
1. Ground man not co-ordinating latching operation with the crane operator.
2. Damaged starting mechanism.


TRANSMITTER WILL NOT ACTUATE FUEL PUMP RACK
ump Rack
Rack dirty.
Defective rack.
Rack return spring mechanism loose or damaged.
Receiver
1. "O" rings damaged or worn.
2. Loose hose connection.
3. Piston stop screw set too tight.
4. Receiver loose or damaged.
5. Defective receiver.
Hydraulic Lines
1. Loose or damaged.
2. Air in lines.
3. Insufficient hydraulic fluid in lines.
Transmitter
1. No fluid in reservoir.
2. "O" ring packing worn.
3. Piston or cylinder walls scored.


LOSS OF COMPRESSION
Combustion Chamber
Ram
Anvil
Cylinder
Injector
1. Held too long at top of stroke before release for start.
2. Worn rings.
1. Loose grease fittings.
2. Grease fitting broken or lost.
3. Worn rings.
1. Scored walls.
1. Loose.
2. Installed without proper washer.
3. Washer damaged.
4. Dirt or carbon under washer seat.
5. Defective adapter gasket.
Upper Cylinder
Compression Tank
1. Loose head bolts.
2. Head gasket damaged.
3. Scored cylinder walls
1. Tank loose or defective tank gasket.
2. Drain plugs loose.
3. Worn rings on top of ram.
4. Scored cylinder.


EXHAUST EXCESSIVELY SMOKY
Lube Oil
Fuel
1. Too much lube oil (one drop per stroke is sufficient).
2. Lube oil may be too light.
3. Incorrect oil.
4. Incorrect fuel.
1. Low grade fuels smoke excessively.
2. Defective injector.


LUBRICATION
Insufficient Lubrication
Excessive Lubrication
Dry Ram
1. Too many shims beneath lube pump.
2. Water condensation. (If below freezing, condensate may be frozen).
3. Clogged lube filter.
4. Air locked lube lines.
5. Defective lube pumps.
6. Lube oil too heavy.
7. Broken lube line.
8. Empty lube tank.
9. Defettive check valves.
1. Not enough shims beneath lube pump.
2. Defective lube pumps.

APPENDIX A
BASIC ISSUE-ITEMS-LIST-AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST

Section I. INTRODUCTION

A–1. Scope

This appendix lists items required by the operator for operation of the hammer.

A–2. General

This list is divided into the following sections:

a. Basic Issue Items List—Section II. Not applicable.

b. Items Troop Installed or Authorized List—Section III. A list of items in alphabetical sequence, which at the discretion of the unit commander may accompany the hammer. These items are NOT SUBJECT TO TURN-IN with the hammer when evacuated.

A–3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized List, Section III.

a. Source, Maintenance and Recoverability Code(s) (SMR): (Not applicable).

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A two character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft. ea, pr, etc.

e. Quantity Furnished with Equipment (BIIIL). (Not applicable).

f. Quantity Authorized (Items Troop Installed or Authorized). This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal stock number	(3) Description: Ref no. & mfr code; Usable on code	(4) Unit of meas	(5) Qty auth
	5120-198-5390	Socket Wrench	EA	1

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25B (qty rqr block No. 418), Organizational maintenance requirements for Pile-Drivers.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

B-2. Explanation of Columns in Section II

a. Group Number. Column 1. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes (obtained from TB 750-93-1, Functional Grouping Codes) are listed on the MAC in the appropriate numerical sequence. These indexes are normally set up in accordance with their function and proximity to each other.

b. Functional Group. Column 2. This column contains a brief description of the components of each functional group.

c. Maintenance Functions. Column 3. This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

C - Operator or crew
O - Organizational maintenance
F - Direct support maintenance
H - General support maintenance

The maintenance functions are defined as follows:

A - INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B - TEST. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C - SERVICE. To clean, to preserve, to charge, to paint, and to add fuel, lubricants, cooling agents, and air.

D - ADJUST. To rectify to the extent necessary to bring into proper operating range.

E - ALIGN. To adjust specified variable elements of an item to bring to optimum performance.

F - CALIBRATE. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G - INSTALL. To set up for use in an operational environment such as an emplacement, site, or vehicle.

H - REPLACE. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I - REPAIR. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and strengthening.

J - OVERHAUL. To restore an item to a completely serviceable condition as prescribed by maintenance serviceability standards using the Inspect and Repair Only as Necessary (IROAN) technique.

K - REBUILD. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements (items) using original manufacturing tolerances and specifications, and subsequent reassembly of the item.

d. Tools and Equipment. Column 4. This column is provided for referencing by code the special tools and test equipment, (Section III) required to perform the maintenance functions (Section II).

e. Remarks. Column 5. This column is provided for referencing by code the remarks (Section IV) pertinent to the maintenance functions.

3. Explanation of Columns in Section III

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the TM/TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Category. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

4. Explanation of Columns in Section IV.

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column 5 and the second letter references a maintenance function, column 3, A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS A INSPECT	B TEST	C SERVICE	D ADJUST	E ALIGN	F CALIBRATE	G INSTALL	H REPLACE	I REPAIR	J OVERHAUL	K REBUILD	(4) TOOLS AND EQUIPMENT	(5) REMARKS
01	Engine													
0101	Crankcase, Block, Cyl Head													
	Anvil	O							F					
	Cylinder, Ay	O							F	F				
	Retainer, Anvil	O							F					
	Head, Cylinder								F	O				
	Stud, Head and Anvil	O							F					
0104	Pistons													
	Damper, Recoil	O							F					
	Ram, (Piston)	O							F					
	Ring, Piston	O							F					
	Ring, Wear	O							F					
0106	Engine Lubrication System													
	Element, Filter(Cleanable)			C					O					
	Filter Ay, Oil			C					O					
	Pump, Oil	O	F						O	F				
0108	Manifold, Air Valve													
	Cover Plates								O	O				
	Plate Air Valve								O	F				
0110	Diesel Starting Controls													
	Latch, Block	O			O				O	O				

SECTION II - MAINTENANCE ALLOCATION CHART

FOR

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS A INSPECT	B TEST	C SERVICE	D ADJUST	E ALIGN	F CALIBRATE	G INSTALL	H REPLACE	I REPAIR	J OVERHAUL	K REBUILD	(4) TOOLS AND EQUIPMENT	(5) REMARKS
0110	Diesel Starting Controls (Cont)													
	Lever, Release	O			O				O					
	Dash Pot Assy	O							F	F				
	Strip, Wear	O							F					
	Rope Assy	O							O	O				
	Latch Block Retainer	O							O	F				
03	Fuel System													
0301	Injectors													
	Injector, Assembly	O	O	O					O	F			1, 2	A
	Nozzle, Injector	C		C					F	F			3	B
0302	Fuel Pumps													
	Pump, Fuel injection			O	F				O	F	H			
	Roller, Cam	O							F					
0306	Rank, Lines, Fittings													
	Cap, Fuel Tank	O							O					
	Tank, Fuel and Oil			C					O	F				
0309	Fuel Filters													
	Fuel Filter Ay			O					O					
	Fuel Filter, Element			C					O					
0311	Engine Starting Aids													

SECTION II - MAINTENANCE ALLOCATION CHART -

FOR

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS A INSPECT	B TEST	C SERVICE	D ADJUST	E ALIGN	F CALIBRATE	G INSTALL	H REPLACE	I REPAIR	J OVERHAUL	K REBUILD	(4) TOOLS AND EQUIPMENT	(5) REMARKS
0311	Engine Starting Aids (Cont)													
	Injector Fuel, Starting	O		O					O					
22	Miscellaneous body, chassis or Hull and Accessory Items													
2210	Data Plates and Instruction Holders													
	Plates, Data	O							F					
	Plates, Instruction	O							O					
43	Hydraulic, Fluid, Air and Vacuum Controls													
4301	Strainers, Filters, Hose Pipe Fittings, Tubing, etc.													
	Fittings, Hose	O							O					
	Hose Assemblies	O							O					
4305	Manifold, and/or Control Valves													
	Piston, Transmitter and Receiver	O							O	F				
	Hydraulic								O	F				
	Valve, Relief								O	F				

SECTION II - MAINTENANCE ALLOCATION CHART

FOR

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTIONS A INSPECT	B TEST	C SERVICE	D ADJUST	E ALIGN	F CALIBRATE	G INSTALL	H REPLACE	I REPAIR	J OVERHAUL	K REBUILD	(4) TOOLS AND EQUIPMENT	(5) REMARKS
4309	Hydraulic Controls and/or Manual Controls													
	Lever, Lock	O							O					
	Cam Stop	O							F					
74	Crane, Shovels, and Earth Moving Equipment Components													
7413	Pile Driver Attachment													
	Cap, Pile Driving	C							O					
	Disc, Aluminum, Pile Driving	C							O					
	Hammer, Pile Driving	C	C	C					O	O	F	D	4	C
	Adapter	O							O				5	D

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

REFERENCE CODE	MAINTENANCE LEVEL	NOMENCLATURE	TOOL NUMBER
1 - H	O	Lever, Priming	3895-487-4347
2 - H	O	Wrench, Socket Key	5120-198-5390
3 - C	C	Kit, Cleaning: Nozzle	3895-087-4351
4 - H	O	Brocket, Lifting	
5 - H	O	Bolt, Eye	5306-487-4891

Section IV. REMARKS

REFERENCE CODE	REMARKS
A - H	Remove, adjust and install injector assembly.
B - C	Service of injector assembly includes cleaning Tip.
C - H	Positioning upper cylinder.
D - H	Positioning cushion adapter cap.

By Order of the Secretary of the Army:

W.C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-25, Sec II (qty rqr Block # 418), Organisational maintenance requirements for Hammers, Pile-Driving.

☆GOVERNMENT PRINTING OFFICE : 1990 O - 262-912 (30498)

PIN : 025339-000